AVIATION WEEK

50 CENTS

Light Weight—Isochronous Governing

New Honeywell Hydro-Mechanical Fuel Control

ANOTHER quality engine control joins the Honeywell line with the introduction of the new Series 40 hydro-mechanical fuel control for gas turbine engines.

The new unit is designed to control fuel flow automatically on turboprop and turbojet engines with a fuel flow of up to 6,000 pounds per hour. It is operational to 60,000 feet with a ram ratio of 1.8.

The Series 40 Control is isochronous governing and features inlet air compensation—automatically correcting fuel flow for variations in inlet air temperature and pressure. It is unusually light and compact—under 10 pounds and less than 120 cubic inches. It was designed to be repackaged to fit any envelope.

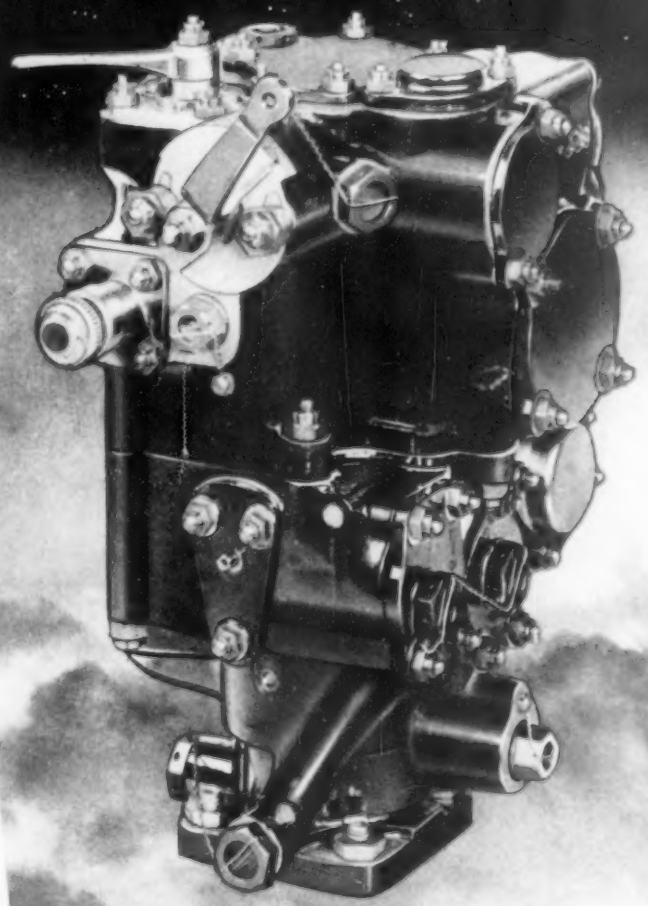
This exceptional new control is another in a long series of rugged yet precise airborne controls based on the experience and know-how of the world's largest manufacturer of automatic controls.

For complete information on this and other engine controls, write Dept. AW-10-156, at the address below.

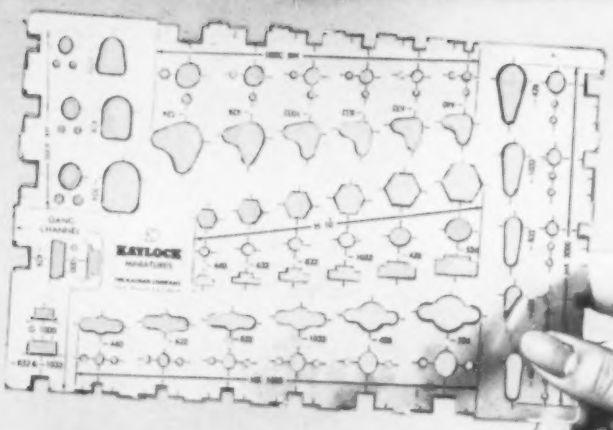
MINNEAPOLIS **Honeywell**

Aeronautical Controls

2600 Ridgway Road, Minneapolis 13, Minn.



E B POWER GS
UNIVERSITY MICROFILM IN
313 N 1ST ST
ANN ARBOR MICH



Ask for our free drafting template of Kaylock miniatures. All configurations — all size of anchor nuts. Includes also standard hex nuts and gang channel.

design engineers point to . . .

KAYLOCK
TRADE MARK

miniatures
all metal self-locking nuts

...when space is at a premium — here is a nut — the smallest in overall size — that completely solves your fastening problem — the biggest single advance in the history of self-locking nuts.

- **'Infinite' reusability**
- **Lightest weight**
- **Lowest height**
- **Maximum strength**

MAIL COUPON TODAY

The Kaynar Company
Kaylock Division Dept. T
Box 2001, Terminal Annex
Los Angeles, California

Gentlemen: Please send me without charge your drafting template of Kaylock miniature all metal self-locking nuts.

Name_____

Company_____

Position_____

Address_____

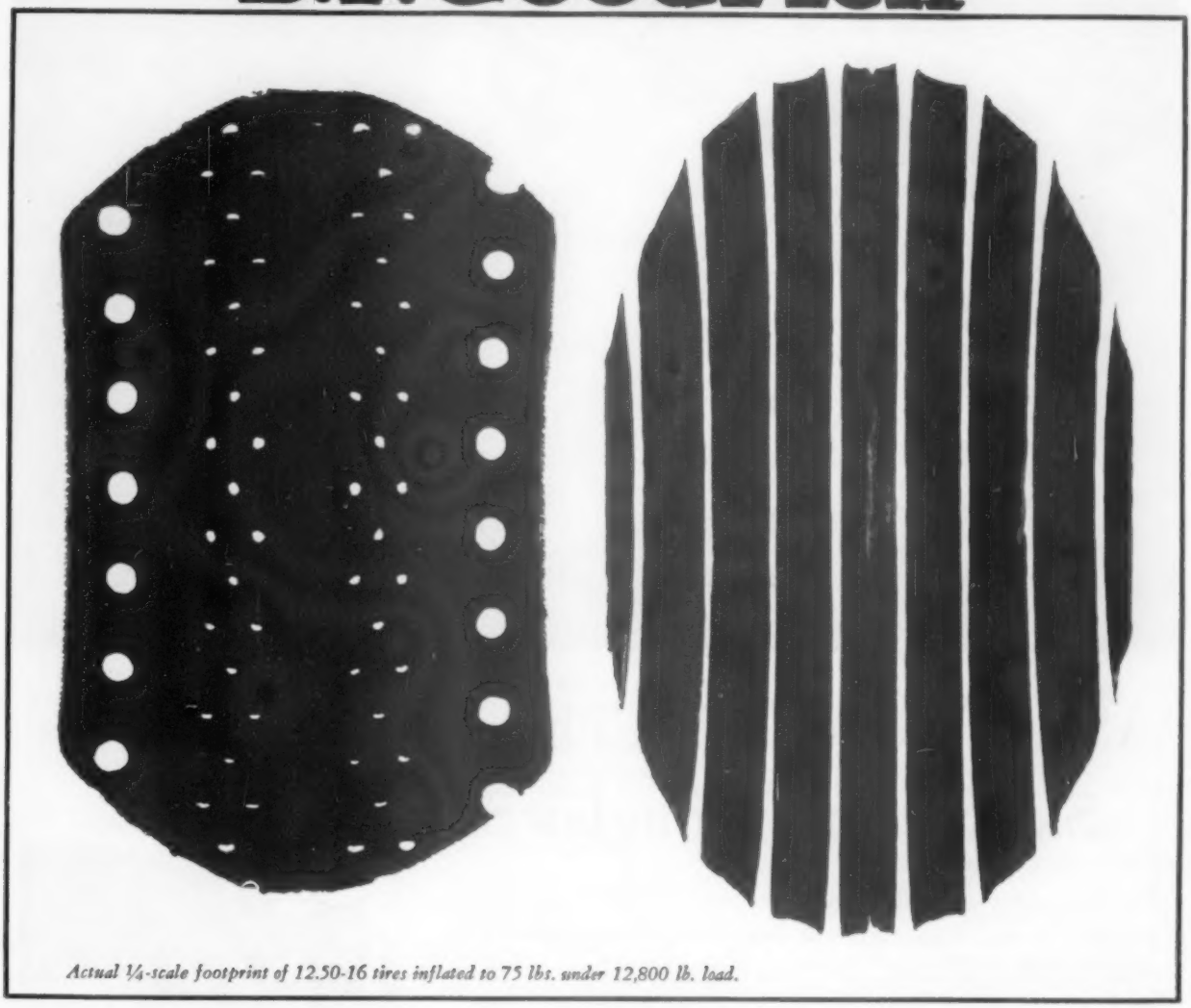
State_____

Kaylock nuts are also available in standard anchor nut envelopes and are precision products produced in full conformance with Air Force-Navy specifications AN-N-5 and AN-N-10.

THE KAYNAR COMPANY · KAYLOCK DIVISION · BOX 2001, TERMINAL ANNEX LOS ANGELES, CALIFORNIA

Canada Distr.: Abercorn Aero Limited, Montreal

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Actual ¼-scale footprint of 12.50-16 tires inflated to 75 lbs. under 12,800 lb. load.

Which tread gives more landings . . . Dimpled or ribbed?

YOU CAN JUDGE a tire by its footprint. The B. F. Goodrich tread pattern on the left gives 10% more landings before recapping, on the average, than the ribbed design on the right!

Why? First, take a good look at the more compact, more rectangular footprint of the B. F. Goodrich Dimpled Tire. That's the result of an overall improvement: the tread profile of the Dimpled Tire is designed to put more tread rubber to work and to spread the load more evenly—shoulder to shoulder. Unlike the conventional ribbed tire which places most of the load on the center ribs, the shoulders of the BFG Dimpled Tire bear their fair share of the load.

Second, notice the most significant difference between the tread patterns—the use of cup-like indentations in the B. F. Goodrich Tire. This unique design further reduces wear because the tread rubber around each dimple is compressed under load—making it more stable and much more resistant to cuts and tears.

Like the first high-pressure Tubeless Tire and the first 300 mph Tubeless, the Dimpled Tire is another example of B. F. Goodrich leadership in research and engineering. Latest example: the first aviation Tubeless Tires in commercial service are Dimpled. *The B. F. Goodrich Company, Tire & Equipment Div., Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
AVIATION PRODUCTS

Tires, wheels, brakes • De-Icers • Heated rubber • Fuel cells • Avtrim • Pressure Sealing Zippers • Inflatable seals • Rivnuts • Hose, accessories

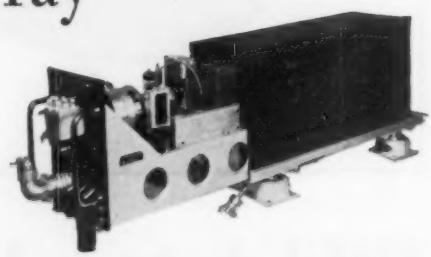
ASCOP "*Shadows*" This Sky-Searing Douglas Skyray

To follow every move, to know every mood of the rapier-like Douglas "Skyray" during her Navy tests, Douglas employed the ASCOP Pulse Width Data Recording System.

How high? How fast? How hot? How much pressure? Stress? The ASCOP System had all the answers.

As many as 88 channels of data can be sampled, transmitted and/or recorded with critical accuracy, under any and all conditions, with this equipment. The real time output of each channel may be metered and recorded. The data may be transmitted by radio link to the ground station . . . or tape recorded in the aircraft for later study.

Why not contact ASCOP regarding your present program?

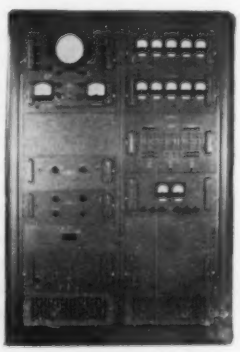


"D" SERIES PW DATA EQUIPMENT

For aircraft, mobile or other applications where recovery or continued use is practical and where space and weight are not critical. Samples up to 43 data sources.

PW GROUND STATION

Separates and reduces all data channels in real time. Operates on signals from standard airborne set, FM/FM sub-carrier, or magnetic tape recorder.



OPPORTUNITY

This fast-growing organization has openings in engineering, administration and sales. Contact our Princeton office.

ASCOP

WE PROVIDE THE LEVER • YOU MOVE THE WORLD

Applied Science Corp. of Princeton

P.O. Box 44, Princeton, N. J. • Phone PLainsboro 3-4141

1641 S. LaCienega Blvd., Los Angeles 35, Calif

Phone Crestview 1-8870

'CTOBER 17, 1955

AVIATION WEEK

VOL. 63, NO. 16

Editorial Offices

New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phone National 8-3414
Los Angeles 17—1111 Wilshire Blvd., Phone MAdison 6-4323

PAA Orders First U. S. Turbojet Fleet 7
► Pan American announces orders for 25 Douglas DC-8s, 20 Boeing 707s at a total cost of $269 million.

USAF to Give Industry Secret Plans 12
► ARDC will furnish aircraft firms advance technical data in another move to speed weapons-system developments.

Gnat Wages Uphill Battle for Acceptance 34
► Folland's light fighter-interceptor design is praised by pilots, hampered by military, civil-service foot dragging.

Slim Profit Margins Plague Airlines 135
► Sir William Hildred tells New York IATA meeting of traffic growth, cost increase, postal-rate problems.

MISSILE ENGINEERING
Falcons for ADC 14
Hughes Speeds Falcon Output 14

AERONAUTICAL ENGINEERING
Rolls-Royce Reviews Jet Problems 46
Navy Opening Giant Engine-Test Facility 60

AVIONICS
GE Introduces Ceramic Tube 71
Avionic Proposals for Traffic Control .. 79
Filter Center 83
Avionic Bulletins 85
New Avionic Products 87

FINANCIAL
Defense Contractor List Attack 16
P&WA Gets Certificate of Necessity .. 23

AVIATION SAFETY
Shop Error Behind UAL Crash 111

EQUIPMENT
New Aviation Products 93
Also on the Market 95
What's New 131

AIR TRANSPORT
CAA Liberalizes Airport Aid 14
Hawaii Airlines Studies Fokker 25
CAB Proposes Pacific Mail Rate 29
Slim Profit Margins Plague Airlines ... 135
International Fares Increase 137
CAB Reduces Subsidy Estimates 139
Shortlines 139
CAB Orders 143
Flying Tigers to Give Up DC-6s 143
Airline Traffic—August 1955 145
Cockpit Viewpoint 146

BUSINESS FLYING
NBAA May Subsidize Transport Design. 18

MANAGEMENT
Military-Civil Traffic Plan Test 13
Federal Contractor Policy Scored 21
Atomic-War Training Accelerated 31
Who's Where 9, 107
News Digest 7
Industry Observer 9
Washington Roundup 11

Calendar 8

EDITORIAL
Every Five Seconds 150

PUBLISHER ..... Robert W. Martin, Jr.
EDITOR ..... Robert B. Hotz

MANAGING EDITOR ..... Alpheus W. Jessup
ASST. MANAGING EDITOR (Technical) David A. Anderton
WASHINGTON ..... G. J. McAllister
WEST COAST ..... William J. Coughlin
ENGINEERING ..... Irving Stone, Henry Lefer
AVIONICS ..... Philip J. Klass
CONGRESS ..... Katherine Johnsen
MILITARY ..... Claude O. Witze
TRANSPORT ..... Craig Lewis, Preble Staver
EQUIPMENT ..... G. L. Christian
BUSINESS FLYING ..... Erwin J. Bulban
ART EDITOR ..... Lawrence J. Herb
EDITORIAL PRODUCTION ..... Jerome E. Kelley
EDITORIAL ASSISTANTS
Victoria Scoparino, Bernie Lang, Betty Hein
LIBRARIAN ..... Jeanne Rabstejnek

FOREIGN NEWS SERVICE

EDITOR ..... John Wilhelm
LONDON ..... Edward W. S. Hull
PARIS ..... John O. Coppock
BONN ..... Gerald W. Schroder
MEXICO CITY ..... John H. Kearney
RIO DE JANEIRO ..... Peter Weaver
TOKYO ..... Dan Kurzman
BOMBAY ..... Gordon Graham

DOMESTIC NEWS BUREAUS

ATLANTA 3 ..... 801 Rhodes-Haverty Bldg.
CHICAGO 11 ..... 520 No. Michigan Ave.
CLEVELAND 15 ..... 1510 Hanna Bldg.
DETROIT 26 ..... 856 Penobscot Bldg.
HOUSTON 25 ..... 1303 Prudential Bldg.
LOS ANGELES 17 ..... 1111 Wilshire Blvd.
SAN FRANCISCO 4 ..... 68 Post St.
WASHINGTON 4 ... 1189 National Press Bldg.
Aviation Week is served by Press Association Inc., a subsidiary of Associated Press.

BUSINESS

BUSINESS MANAGER ..... J. G. Johnson
PROMOTION MANAGER ..... T. B. Olsen
PRODUCTION MANAGER ..... W. V. Cockren

SALES REPRESENTATIVES

NEW YORK ..... J. C. Anthony
CLEVELAND ..... H. P. Johnson
CHICAGO and ST. LOUIS D. T. Brennan, J. S. Costello
BOSTON ..... E. P. Blanchard, Jr.
DALLAS ..... James Cash
ATLANTA ..... William D. Lanier, Jr.
SAN FRANCISCO ..... T. Evans Wycoff
LOS ANGELES C. F. McReynolds, Gordon Jones
PHILADELPHIA ..... W. S. Hessey
DETROIT ..... C. A. Ransdell

RESEARCH AND MARKETING

Irina Nelidow, Mary Whitney Fenton, Elinore Eisenson.

58,510 copies of this issue printed

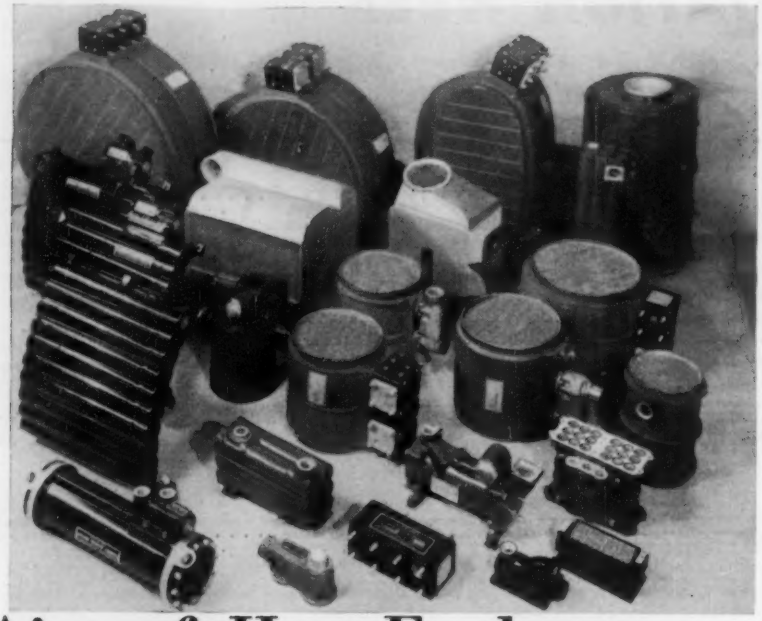
AVIATION WEEK • OCTOBER 17, 1955 • Vol. 63, No. 16
Member ABP and ABC

Published weekly by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive Editorial, Advertising and Subscription Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A. Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable Address: "McGraw-Hill New York". Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.



Aircraft Heat Exchangers...

As performance requirements go up, Clifford's Wind Tunnel Laboratory assumes a major industry role.

The numerous heat exchangers illustrated on this page have one important thing in common. They all represent successful answers to heat transfer problems that hadn't been solved until Clifford's Wind Tunnel facilities were put to work.

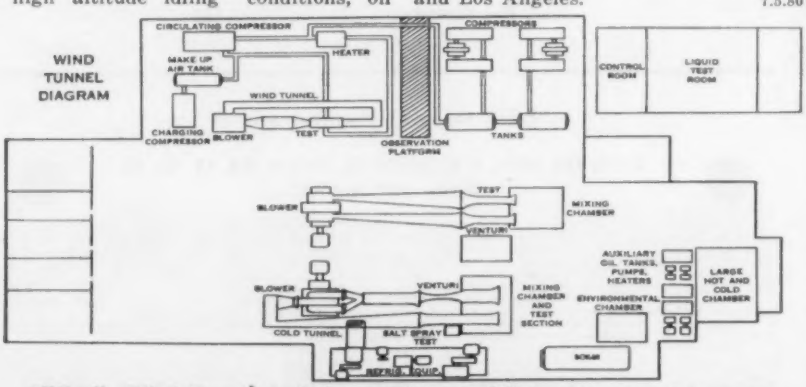
Each one of these heat exchangers represents a different problem — and some of them were highly unusual, involving designs featuring very high capacities within strict limits of space, weight and sometimes shape. In each case, Clifford designed and manufactured the thermal valves that control the oil flow, producing a complete "package" ready to mount for service.

Units have been developed for many different applications, including temperature control of engine lube oil, hydraulic system fluids, afterburner lubricant, cabin, cockpit, gun and camera compartments as well as wing and empennage anti-icing equipment. Recent work of interest includes special air type lube oil coolers for jets to meet "high altitude idling" conditions, oil coolers to meet the highly variable conditions encountered by helicopters in their changes of flight direction from vertical to horizontal. The problems of rocket flight, missiles and the temperature control of avionic equipment are currently receiving attention. The company is also deep into the unusual problems of heat exchange involving the handling of molten metals for atomic energy applications.

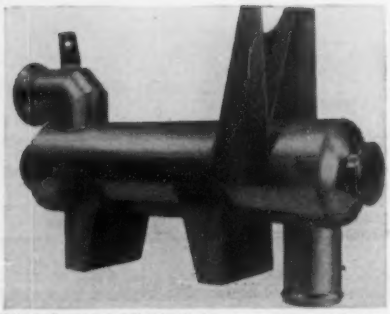
In all these areas, Clifford's unmatched facilities for development and design plus production capacity to provide heat exchangers in needed quantities is your finest assurance of securing the best solution to your problem.

A letter or phone call will put the world's most completely equipped technical facility of its kind to work on *your* problem. Clifford Manufacturing Company, 152 Grove Street, Waltham 54, Mass. *Division of Standard-Thomson Corporation.*

Telephone: WAltham 5-7310. Branch offices in New York, Detroit, Chicago and Los Angeles. 7.5.80

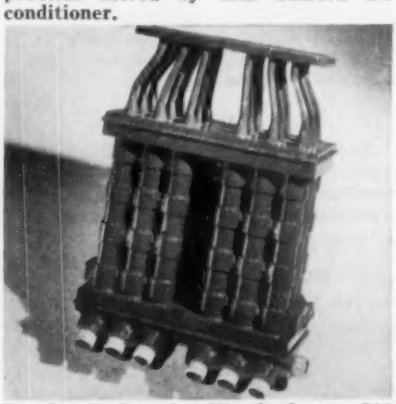


Clifford's Wind Tunnel facilities provide capabilities for accurately reproducing the conditions encountered by aircraft in actual service on any part of the globe and at altitudes from sea level to 80,000 feet.



Stainless steel high temperature air-to-air heat exchanger. Clifford's ability to weld and braze stainless steel successfully, plus its unique test facilities gives the company unusual advantages in the new high temperature ranges of aircraft heat exchange applications.

How to put adequate heat transfer capacity into a restricted space in Republic's RF84F camera compartment to prevent camera port fogging was the problem solved by this Clifford air conditioner.



Developed for the Westinghouse J46 turbojet engine, this oil cooler was first to employ the vaporizing principle in lube oil cooling service. It provided greater heat rejection capacity per unit of fuel flow than ever previously attained.

Both 707s and DC-8s

PAA Orders First U. S. Turbojet Fleet

Pan American World Airways last week signed contracts totaling $269 million for the first major American turbojet airline fleet, ordering 25 Douglas DC-8s and 20 Boeing 707s.

Boeing's Jet Stratoliners will be delivered first, beginning in December 1958. Within five months thereafter, Pan American says it will place these American-built, American powered transports in service on its trans-Atlantic, South American and trans-Pacific routes. Boeing will complete its deliveries by Nov. 1959.

Deliveries of the Douglas jet airliners are scheduled to begin in December 1959 and to be completed by January 1961.

Both aircraft will provide 550 mph. transocean and transcontinental service. The 707, larger and faster than the prototype now flying, will have a range of more than 5,000 miles nonstop. Douglas states that the DC-8 will be "capable of nonstop operations in either direction between New York and London or Paris against headwinds."

Both are designed to cruise up to Mach .88, and the contracts guarantee cruising speeds of 575 mph. at 30,000 ft. altitude.

Pan American lists these potential flight times with the new jet airliners: New York to Paris, 6 hr. 35 min.; New York to Buenos Aires, 11 hr., 15 min.; Chicago to London, 6 hr., 45 min.; Tokyo to Seattle, 8 hr., 32 min. and Honolulu to San Francisco, 4 hr., 30 min.

The Boeing 707s, powered by Pratt & Whitney J57 engines, will carry 104 passengers in standard (first class) configuration and 125 in tourist. Each airplane will cost just under $7 million.

Douglas' DC-8, with a wing area approximately 7% greater than the 707, is designed to carry 108 passengers in standard seating arrangements or 131 tourist class passengers. Pan American says the DC-8 will have "slightly greater range and will be equipped with a larger type Pratt & Whitney jet turbine engine," the P&W J75 (commercial designation, JT4).

Douglas said that its August announcement of the DC-8 performance was based on the J-57, but "the Pan American planes covered by the present contract are designed to utilize jet engines of even greater power and versatility as and when they become available for commercial use."

The DC-8 purchase calls for expenditures in excess of $160 million for the 25 aircraft and spares.

Jet turbine silencers and reverse thrust mechanisms will be installed. With the silencers, Juan T. Trippe, president of PAA, says, "The new jets will make little more noise on the ground than present piston-engined planes." Reverse thrust will be used for braking effect after landing.

The order for jet airliners does not effect the existing $88 million order for 33 DC-7Cs with turbo-compound engines. The first of these will be delivered in the spring.

The combined commitments, totaling $357 million for new flight equipment, are "evidence of Pan American's faith and confidence in the continued expansion of sound two-way international trade as well as greatly increased tourist travel between the United States and the 74 friendly foreign nations which are regularly served by the Pan American Clippers," Trippe stated.

Pan American is non-committal about its long-standing, and perhaps still existing, order for de Havilland Comet 3s. In a statement to AVIATION WEEK, the company said: "PAA has a continuing interest in the de Havilland jet program. Certain confidential written understandings exist between the two companies looking toward a successful outcome."

NEWS DIGEST

U. S. Navy last week grounded the North American FJ-3 Fury jet fighter pending modification of its Wright J65 turbojet engine to prevent overheating.

Convair is discussing a 500 mph. turboprop airliner with Canadair (another General Dynamics division) and Bristol Aeroplane Co. The design for delivery in 1960 probably, is the advanced, thin-wing version of the Bristol Britannia (AW Oct. 25, 1954, p. 13). It will be powered by the Bristol B. E. 25 engine. Canadair is building a military reconnaissance version of the Britannia for RCAF.

A new and complete helicopter control system providing full all-weather operating capability has been developed by Sperry Gyroscope Co., division of the Sperry-Rand Corp. Sperry has just received clearance from USAF to announce details.

United Air Lines September traffic reached a new record for the month with 386,982,000 revenue passenger-miles and 9,693,000 plane-miles, 18 and 19% increases respectively over the same period last year. Freight shipments were up 35% to 4,098,000 ton-miles, express up 27% to 1,276,000 ton-miles and mail up 6% to 2,007,000 ton-miles. Late summer vacationists and school returnees are credited for the traffic increases.

Slick Airways carried a record 4,320,379 ton-miles of airfreight on domestic scheduled service in September, 14% more than the same month last year. Figure does not include the carrier's domestic and overseas charter flights. George M. Bain, Slick executive vice president, predicts a 30% increase in the airline's volume this year over 1954 and a 20% increase in airfreight for all airlines.

Wright Brothers Lecture will be delivered by Raymond L. Bisplinghoff on Dec. 17 in the auditorium of the U. S. Chamber of Commerce Building, Washington, D. C. The lecture is sponsored by The Institute of the Aeronautical Sciences.

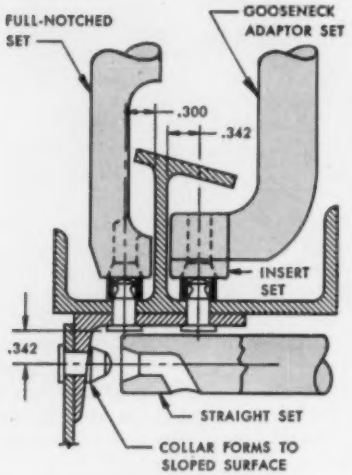
Elastic Stop Nut Corp. of America reports $1,101,756 profit after federal taxes for nine months ended Aug. 31. Net sales totaled $14,941,443 compared with $17,086,429 for the same period last year. Firm has voted a 25 cents common dividend payable Nov. 1 to holders of record Oct. 15.

Prototype Saab delta fighter, reportedly capable of 1,000-mph. speeds, is scheduled to fly soon at Linkoping, Sweden. Developed as a result of flight studies with the tiny half-scale Saab Draken, the new multi-engine fighter is about 50 ft. long and has a span of approximately 35 ft. According to present estimates, orders for the delta will total some $150 million and is designed to provide the backbone of the Swedish Air Force in the late 1950s and early 1960s.

Bendix Radio settled its 39-day old strike last week by giving the International Association of Machinists (AFL) a six cents hourly raise with another six cent increase to follow in September 1956. The settlement, which may serve as a pattern for at least part of the avionics industry, included a seventh paid holiday and improved pension and insurance plans.

HERE'S A TOUGH PROBLEM OF ACCESSIBILITY

for some fasteners but easily licked with HI-SHEARS!



Above minimum layout dimensions are for ¼" diameter Hi-Shear rivet.

Because of its minimum protrusion, weight and tool clearance, the HI-SHEAR rivet is installed into critical space areas not accessible to other high strength fasteners.

Inexpensive HI-SHEAR Sets are available in a variety of shapes and sizes.

HI-SHEAR tools are used in standard rivet guns and squeezers — eliminating special single purpose driving equipment.

Write for the Tool Catalog for tool dimensions.

U.S. and foreign patents—Trademark registered.

hi-shear RIVET TOOL COMPANY
9924 BELLANCA AVE. LOS ANGELES 45, CALIFORNIA

AVIATION CALENDAR

Oct. 18-19—Seventh annual Aerial Dusting and Spraying Conference, sponsored by the Washington State Aeronautical Commission and the State College of Washington, Wenatchee, Wash.

Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.

Oct. 24-25—Institute of Radio Engineers' Professional Group on Electronic Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.

Oct. 25-27—Technical Conference on Aircraft Electrical Applications, American Institute of Electrical Engineers, Hollywood-Roosevelt Hotel, Los Angeles.

Oct. 26—Airwork-AC Aviation Spark Plug Clinic, at International Aviation Industries, Inc., Westchester County Airport, White Plains, N. Y.

Oct. 26-28—Southwestern Airport Managers' Assn., annual meeting, Greenville, S. C.

Oct. 27-28—Aircraft Electrical Society, 12th annual display, Pan Pacific Auditorium, Los Angeles.

Oct. 30—Second annual Topeka Aviation Day, Topeka, Kan.

Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.

Oct. 31-Nov. 2—Society of Automotive Engineers, Golden Anniversary Transportation Meeting, Chase Hotel, St. Louis.

Nov. 2-4—Society of Automotive Engineers, Golden Diesel Engine Meeting, Chase Hotel, St. Louis, Mo.

Nov. 3-4—Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, second annual joint meeting, Chateau Laurier, Ottawa, Ont., Canada.

Nov. 8-10—National Aviation Trades Assn., annual convention, Hotel Westward Ho, Phoenix, Ariz.

Nov. 9-10—Society of Automotive Engineers, Golden Anniversary Fuels & Lubricants Meeting, Bellevue-Stratford Hotel, Philadelphia.

Nov. 9-11—Industrial Management Society, 19th annual time, motion study, management clinics, Hotel Sherman, Chicago.

Nov. 13-18—American Society of Mechanical Engineers & American Rocket Society, annual convention, Congress, Hilton and Blackstone Hotels, Chicago.

Nov. 14-15—Aviation Distributors & Manufacturers Assn., 26th meeting, El Mirador Hotel, Palm Springs, Calif.

Nov. 14-17—Second International Automation Exposition, Navy Pier, Chicago.

Nov. 16-18—Society for Experimental Stress Analysis, annual meeting, Hotel Sheraton, Chicago.

Dec. 2-3—Eighth Annual Aviation Conference & Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6-7—Professional Race Pilots' Assn., convention, Carter Hotel, Cleveland.

Dec. 12-17—Nuclear Congress and Atomic Exposition, sponsored by Engineers Joint Council, Cleveland Municipal Auditorium.

PICTURE CREDITS

29—Howard Levy.

It's the careful attention and hand-crafted workmanship on every minute detail of fabric color and texture combinations with the proper touch of thermoplastics and metallic appointments that give TECO airline seats that extra freshness of appearance! TECO's styling is another reason leading airlines agree the finest airline seats are TECO-built!

WRITE FOR FULL PARTICULARS TODAY!

TECO INC.

2501 No. Ontario St. • Burbank, California

Airline • Executive • Military Aircraft Seats

WHO'S WHERE

In the Front Office

Lloyd E. Schumacher, vice president-sales and customer relations of the T. B. Rea Co., Inc. **Daniel T. Gundersen**, vice president-engineering and production.

E. F. Giguere, vice president-sales of Transistor Products, Inc.

A. H. Hardwick, vice president of International Resistance Co.

W. M. Clough, vice president-general manager of Mason Electric Corp.

George W. Baughman, vice president-general manager of Union Switch & Signal, Div. of Westinghouse Air Brake Co. Other changes: **Dr. F. E. Lowance**, director of research and engineering; **E. F. Brinker**, manager of research and development; **D. P. Fitzsimmons**, assistant manager of research and development.

Thomas J. Hargrave, board member of Westinghouse Electric Corp.

Whitney Straight, executive vice chairman of the board of Rolls-Royce Ltd., Derby, England.

A. E. Underwood, board member of Plessey Co., Ltd., Ilford, Essex, England.

Honors and Elections

Alexander Kartveli, vice president and chief engineer of Republic Aviation Corp., received honorary doctor of engineering degree from the Polytechnic Institute of Brooklyn.

Frederick B. Lee, CAA administrator, received a special citation from the National Business Aircraft Association for distinguished service in the advancement of civil aviation.

Peter F. Hurst, president and general manager of Aeroquip Corp. and **William P. Lear**, chairman of the board and director of research of Lear, Inc., became members of Tau Beta Pi, National Honorary Society.

Changes

Adm. Robert B. Carney (USN-Ret.), consultant to Westinghouse Electric Corp.

Charles E. Davy, consultant at Aluminum Industries, Inc., Cincinnati, Ohio.

Dr. Franklin Kingston Moore, chief of aerodynamic research dept. at Cornell Aeronautical Laboratory, Inc.

R. V. Lynch, sales and service manager of Chance Vought Aircraft, Inc.

Robert T. Hamlett, publication director of Sperry Gyroscope Co., Div. of Sperry Rand Corp.

G. D. Mole, project engineer-engines of Smiths Aircraft Instruments Ltd., London, England.

Allan A. Barrie, general manager of Iranian Airways.

Leslie G. S. Hyland, commercial manager of British West Indian Airways.

W. V. Phillips, chief of industrial relations of the Beverly Hills Electronic Equipments Div. of Litton Industries.

Charles C. Snider, field sales manager of Consolidated Engineering Corp.

(*Continued on page 107*)

INDUSTRY OBSERVER

► North American Aviation has been picked to build the rocket powered piloted research aircraft to explore altitudes above 100 miles (520,000 ft.). Project is a continuation of the joint USAF-Navy-NACA research aircraft program. Bell Aircraft Corp. and Douglas Aircraft, which have built most of the earlier supersonic research aircraft, were also contenders for the high altitude job.

► **USAF is considering organization of a second intercontinental ballistics missile project as a back-up for the Atlas project now under way. Lockheed, Douglas and Martin are under consideration as possible weapon system managers for the new project.**

► Curtiss-Wright has been informed by USAF that no production versions of its J67 twin spool 12,000 lb. thrust turbojet will be ordered. Experimental J67s will be used in the Republic Aviation F-103 experimental high speed aircraft.

► **Glenn L. Martin Co. will soon roll out the B-57D with two Pratt & Whitney J57 turbojets replacing the Wright J65 Sapphires. Engine nacelles have been enlarged to accommodate the more powerful, larger and heavier J57. New nacelles jut well forward of the aircraft wing.**

► Air Defense Command is now planning to use the Lockheed F-104 supersonic day fighter as its inner defense aircraft.

► **Marquardt Aircraft Co. is experimenting with solid propellents for ramjet fuel.**

► French SS-10 air to surface missiles are being flight tested in a Dassault 315 Flamant twin engine transport. Tests are aimed at adapting the missiles to the Dassault fighter series.

► **Watch for another attempt on the world altitude record, this time by a Rolls-Royce Avon-powered Canberra P.R. 9 which has more wing area than the earlier Canberra used as an Olympus test bed for the 65,876 ft. record flight. The Rolls-Canberra combination would have to top 68,000 ft. to beat the record by the necessary 3%.**

► De Havilland 110 and Vickers Supermarine 113, under development as advanced fighters for the Royal Navy, will not be able to operate from Hermes or Colossus class carriers. They are too heavy for existing arresting gear.

► **Handley Page Victor has unique aileron control system installed in its thin wing. Conventional push rods operate a helical cam in a torque tube which is also the aileron main spar. Lateral motion of the rods produces torsional motion on the spar and therefore deflection of the aileron.**

► Capital Airlines will take delivery of another three Vickers Viscount turboprop transports in November with additional deliveries to follow at a rate of three per month for the next 12 months. By the end of 1956, Capital expects to operate 42 Viscounts with the balance of its fleet of 60 order to be delivered in 1957.

► **General Electric J79 turbojet, already scheduled for the Lockheed F-104 fighter and the Convair B-58 supersonic bomber, is now under consideration for advanced versions of other century series fighters and in Navy aircraft. Twin J79 installation is being considered for interceptor version of the McDonnell F-101 Voodoo replacing the twin J57s now being used.**

► **General Mills has expanded its "Skyhook" plastic balloon business (AW Oct. 10, p. 45) from $100,000 to $6 million in last eight years. The company makes 5,000 to 6,000 high altitude balloons and 500,000 smaller propaganda balloons per year. General Mills is developing a system for using its "Skyhook" plastic balloons to track hurricanes.**

more miles for missiles
Out where the air is thin, where every ounce of dead weight costs miles, rockets and guided missiles are reaching closer and closer to the fringes of space. Pastushin Force Ejection—product of years of specialized research—assures safe, positive ejection of missile, rocket, bomb and aircraft components.
PASTUSHIN
AVIATION CORP. Los Angeles, Calif.
RESEARCH • DESIGN • DEVELOPMENT • PRODUCTION

Washington Roundup

USAF Policy Speeches

Fall speech-making season for top Air Force executives is in full swing, with signs that USAF public relations policy tends toward frank discussion of its problems at home and abroad. Here were their views last week:

• **USAF Secretary Donald A. Quarles** discounted recent fears that GOP economy measures would curtail U. S. air power. He said: "There never was any question of abandoning our 137-wing program. Secretary Wilson is as determined as any man I know to develop and to maintain the best possible Air Force program." Quarles also warned the free world it cannot relax because of peace talk, or it will find itself with an inferior air arm.

• **General Nathan F. Twining,** Chief of Staff, said the Russians have numerical superiority over USAF but are not ahead of us in total air power. He said the Reds have more fighters than we have and their performance compares favorably with that of U. S. fighters; they outnumber us in light jet bombers but we have "many times more B-47s than the Soviets have Badgers." U. S. and Russia are about even in the heavy bomber field, where the B-52 is compared with the Red Bison. The B-36, once under bitter attack by the Navy and starting to phase out, "perhaps more than any other factor has kept us from being attacked."

• **General Thomas D. White,** Vice Chief of Staff, in the most provocative speech, said that once the nuclear-aircraft engine is perfected as a power unit, the seaplane may join the Air Force as a water-based bomber.

"It is conceivable," Gen. White said, "that a nuclear powered, water-based aircraft may become an effective bomber, suitable for the Air Force's wartime strategic bombing mission.

"Formerly, of course, water-based aircraft had neither the performance nor the capability to be used as Air Force bombers. However, new engine developments may enable the water-based bomber to take its place alongside other Air Force airplanes and missiles."

It was generally assumed that Gen. White's statement is related to U. S. Navy's reported success in early flying tests with the new Martin P6M SeaMaster, jet flying boat. Navy enthusiasts already have pictured the P6M as a nuclear bomb-carrying aircraft, part of a nautical team for modern warfare, including submarines and the new giant Forrestal-class carrier.

The Martin company also is working on new types of equipment for ground handling of seaplanes, including beaching and drydock facilities that will be ready for Navy tests in the near future (AW Oct. 3, p. 13).

Gen. White's note of caution regarding performance is consistent with USAF's policy that "effective weapons —not scientific novelties" must result from any procurement program. He said nuclear-powered aircraft will be flying within the next ten years, but added:

"I must emphasize that in developing both the intercontinental missile and the nuclear-powered airplane, we could have them both sooner if we were willing to accept more gambles and less effective performance."

Major value of the nuclear-powered aircraft, Gen. White said, will be its unlimited range and endurance, which will widen USAF's choice of tactics. It would permit retaliation against an aggressor from any direction and increase the enemy's defense task. In addition, it would be an answer to the enemy's long range missile.

"Theoretically," he said, "we could keep a large proportion of an atom-powered retaliatory force airborne all the time. It could be positioned to accomplish its mission immediately if an enemy were to launch an attack.

"Airborne and relatively invulnerable, it could be even as effective a deterrent as an intercontinental ballistics missile."

Gen. White emphasized that recent Soviet developments in the field of long range bombers has made America's air defense more important, with the size of USAF's job "related to Soviet airpower and its potential capability for aggression.

"For instance, we need enough radars, fighter interceptors, and air defense missiles to effectively blunt the largest attack an enemy is capable of mounting.

"The bomber production of a potential attacker is a factor in determining the number of air defense interceptors and radars we need. Whether he has 1,000 more or 1,000 fewer interceptors than we do is meaningless in our air defense problem because interceptors do not fight interceptors.

"The number of his interceptors is important, however, in determining the number of offensive airplanes we would need for success in our retaliatory attacks," Gen. White said.

Army Loses Round

Watch for Army aviation proponents to press next for revision of the three-year-old "memorandum of understanding" that restricts size and types of aircraft it can use. Air Force insistence that combat support is one of its missions recently led Defense Department to refuse Army request for a few T-37 jet trainers for evaluation in liaison and reconnaissance role. USAF also fears traffic problems if ground forces start sending their own jets out on missions in the midst of battle where they could tangle with fighters out to bomb or strafe enemy troops. USAF now has agreed to lend the Army some planes for tests, but is prepared to stand firm against changes in the memorandum.

Defense Contractors

The report on the 100 largest defense contractors released last week by the Senate Preparedness Investigating Subcommittee (see p. 16) is only a first, preliminary report. There will be other reports shortly dealing with different aspects of the concentration of military business, and the procurement policies Defense Department has followed with big companies.

Senate Banking and Currency Committee headed by Sen. William Fulbright (D-Ark.) is standing by until the investigating subcommittee completes its studies. This committee's interest is the effect defense business has had on the economy in general and the stock market.

Airfields Down Under

Air Force specialists have departed for Australia and New Zealand to study airfields there to determine if they are adequate for use by RB-36 observation planes which will make weather flights over the Antarctic. Included in the party were personnel from Strategic Air Command Headquarters.

—Washington staff

AVIATION WEEK VOL. 63, NO. 16
OCTOBER 17, 1955

USAF Will Give Industry Secret Plans

ARDC will furnish firms advance technical data in effort to speed weapon system developments.

By Claude Witze

Washington—USAF's Air Research & Development Command, joining in the current effort to stimulate new weapon systems contributions by the aircraft industry, is preparing to release its secret Technical Program Planning Documents to a select list of contractors.

The program, not yet completed but due to get under way before the end of 1955, will be started on a "trail balloon" basis with a list of about 100 selected companies, universities and government agencies.

It will mark the first time secret USAF information on the military problems to be faced over the next 10 to 15 years, present capabilities, possibilities and requirements has been made available to the industry.

Full details on the program will be disclosed by Brig. Gen. Thomas L. Bryan, Commander of Wright Air Development Center, at a national meeting of the Institute of Aeronautical Sciences in Dayton, Ohio, Nov. 8.

Policy Implementation

Major importance is attached to the ARDC announcement because it is the first concrete implementation of USAF's new policy of encouraging greater exploitation of aircraft industry development facilities. Lt. Gen. Clarence S. Irvine, Deputy Chief of Staff for Materiel, already has announced that USAF will favor contractors who show achievement in the development field as well as a capability to produce (AW Oct. 10, p. 12).

In addition, ARDC is expected to overcome one of the industry's principal complaints: That USAF's great concern with security ties the hands of both prime contractors and component specialists, keeping from them knowledge essential to intelligent and productive development programs.

The fact that security restrictions have been a stumbling block to further industrial research and development effort has been stressed by the Air Force in recent months. Trevor Gardner, Assistant USAF Secretary for Research and Development told AVIATION WEEK (Sept. 5, p. 14) that one company had offered to start a new program with $25 million if the Air Force would tell all it knows so that the money can be channeled into the most effective fields of research.

Another firm is willing to build a laboratory if USAF will share the operating expense and share its secrets, Gardner said.

He feels that an easing of present security, now to be accomplished through the ARDC program, would go far toward increasing the productivity of available R & D funds.

Lt. Gen. Thomas S. Power, ARDC commander, said the need for faster development is critical and survival depends on a "vast amount of exploratory development." (AW Aug. 22, p. 12).

The ARDC program was disclosed last week by Col. Taylor Drysdale, Chief of Plans and Programs at the command's headquaters in Baltimore, Md. He spoke before a meeting of the Washington section of IAS.

Drysdale said the program got its start about a month ago at the first of a series of Technical Program Symposia held in New York. Interested contractors received an outline from ARDC's guidance and control specialists on seven areas of research in which advances to new frontiers of science are essential.

Another symposium, on aeronautics and propulsion, will be held in Cleveland late in January. By July of next year, Col. Drysdale said, ARDC plans to complete seven meetings, covering each of the command divisions and 46 different areas of R&D.

The program will be repeated annually.

Another major event on the ARDC schedule is an all-industry symposium to be held at the Baltimore headquarters late this year. Instead of the engineers and managers most concerned with R & D, this meeting will bring together the presidents of the major companies supplying USAF to consider policy matters.

"The ultimate purpose of our actions," Col. Drysdale said, "is to expand the base of air research and development to the limit of our authority and ability, and insure that all members of the team are working in consistent directions with consistent terms of reference."

Col. Drysdale emphasized the declaration of the Air Materiel Command that USAF cannot do its job without industry help.

No Contracts

"The role of industry," he said, "lies in the solution of some of the technical problems which obstruct us in the achievement of our performance objectives. Moreover, spontaneous innovations and unsolicited proposals from industry may provide breakthroughs which no plan would deduce.

"Thus we look to science and industry to research new knowledge, generate new techniques, develop new materials and engineer new systems to help provide our qualitative superiority of the future," Col. Drysdale said.

He made it clear that as far as ARDC is concerned technical development is not expected to result in any hardware, only new techniques and capabilities. He made it clear, there are no contracts for industry to seek under the new policy.

It is USAF's intention that industry, given the freer rein it needs and the hitherto secret information on require-

Gerrity on Development

Los Angeles—Maj. Gen. T. P. Gerrity, USAF Director of Procurement and Production Engineering, reported last week that the Air Force will eliminate development programs which fail to offer large gains in performance in a further effort to keep pace with "the tremendous aeronautical progress" of the Soviet Union. Speaking before the Society of Automotive Engineers Aircraft Production Forum, he declared:

"We are not pursuing programs which offer only small incremental gains in performance. The merits of such . . . gains . . . are too often offset by training and logistics complications caused by new and more complex equipment."

To maintain U. S. preeminence in air power, Gerrity said, the Air Force has decided that the pursuit of applied research and development will be selective, that maximum use will be made of competition within the industry and that an all-out effort will be made to shorten the time cycle between development and production.

ments, will compete in the production of new techniques and capabilities. Production contracts, Gen. Irvine has said, will be the reward to those who make contributions and have production capability.

"Research and development operations in this field implement an approved program of operations, designed to produce these techniques and capabilities," Col. Drysdale said. He added that success can be measured only "by the economy and speed with which we carry out the program."

Planning Studies

The new and closer liaison with industry and research centers of all kinds, including universities and government agencies such as the military services and National Advisory Committee for Aeronautics, is needed, he said, to make sure that ARDC plans are carried through.

They must produce what is needed, when it is needed and exploit the best of America's resources.

To assure this kind of action, ARDC conducts a series of studies which result in the Technical Program Planning Documents. The command has divided R & D into 46 areas such as communications, human engineering and active bomber defense. Each area is covered by a TPPD.

Each TPPD is under constant revision to keep it current and is made up of four parts:

- **A definition** of the military problems looking 10 to 15 years ahead including environment and performance conditions.
- **A review and evaluation** of present capabilities giving at this point some indication of the magnitude and direction of the R & D effort.
- **A review** of the technical possibilities, data already known, proposed innovations, avenues of approach.
- **A definition** of the technical requirements or performance objectives. It is a demand on the appropriate ARDC center to achieve these objectives. The average number of technical requirements for each TPPD is three.

Distribution of the TPPD to industry, Col. Drysdale says, will reverse the pattern where contractors "contributed to our qualitative superiority after the basic pattern of USAF R & D effort had jelled. They were not cut into the pattern in time to take part in its design, and so much of their valuable potential was not employed."

Col. Drysdale said the 100 contractors and agencies on the initial "trial balloon" list will be asked to sign agreements before they are given the TPPD's in which they are interested. These will delineate USAF's responsibility for security and in the field of proprietory information. The contractor will agree to surrender the documents at any time his eligibility is changed.

ARDC said distribution of the TPPD is not a request for proposals.

'Reach the Roots'

After the first experiment, it is planned to expand the program to all interested companies and agencies. Eventually, ARDC intends to reach "the roots of U. S. engineering talent" by distributing the information to small companies who can meet the requirements. These will include:

- **Proper security clearance.**
- **Sound evidence** that the field of interest is suitable.
- **Known capability in the field.**

From ARDC's viewpoint, basic motivation for the program is the realization, Col. Drysdale said, "That our future military superiority cannot be won by the greater flood of war materiel which has played so large a part in our military superiority in the past." Quality now is more essential.

He added:

"The bulk of our production of quantity has been achieved by American industry. Likewise, the preponderance of our production of quality must be achieved by American industry.

"It is in (this) realization that we are endeavoring to activate the Air Force-industry team as effectively as possible."

Air Defense Radar, Civil Traffic Systems Joined in Boston Test

By Preble Staver

Washington—Integration of air defense radar and civil air traffic control on a test basis in the Boston, Mass., area was ordered last week by the Air Coordinating Committee. Ultimate objective of the test is to establish the first all-radar airways between Boston and Norfolk, Va.

The action followed strong criticism of the Civil Aeronautics Administration's traffic control system by military and civil experts (AW Oct. 10, p. 15). Lt. Gen. Joseph Smith described the present system as "inadequate and obsolete."

Observers said the action was due to the failure of CAA to incorporate present facilities of the military into a common system with civil equipment. They added that the ACC action may foreshadow a reorganization of CAA, including personnel changes, to eliminate resistance to plans of other federal agencies to provide a true common civil-military system.

The plan for the Boston area was the result of a joint effort by the Air Force, Navy, Air Navigation and Development Board and Civil Aeronautics Administration. Headquarters for the operation will be at Deer Island, an Air Force installation near Boston and the operation will be handled by a CAA-military team.

Test Goals

The experiment embraces three factors.

- **Research and development** on air traffic control systems and elements.
- **Test and evaluation** on air traffic control systems and elements.
- **Control of live traffic** by CAA incorporating the development and evaluation results into the live operation.

CAA's control center on Deer Island will be in addition to the regular operations of the Boston Center initially, until the USAF long range radar can be put into the Boston center.

Remote Radar

In operating the experimental Deer Island center, it is hoped to improve immediately air traffic control in the Boston area as part of the overall tests. This is to be done with an expansion of radar control specifically by remoting long range radar data from military installations in the area.

CAA also will have the opportunity to work with many Air Force projects on Deer Island which have elements comparable to those required in the common system. Among the USAF facilities available are the provision of raw video, which provides a picture of a radar scope, narrow band radar data and computer output data for military evaluation.

The Air Force has been developing, testing and evaluating a military terminal air traffic control approach and land-

Air Traffic Meeting

Air Navigation Development Board in cooperation with the Civil Aeronautics Administration is planning an industry-government symposium on the problems and requirements of the air traffic control system.

ANDB has been assigned the responsibility of coordinating a joint CAA-military research, development, test and evaluation on air traffic control systems and elements.

ing system (TRACALA) which is directly concerned with information from the SAGE system. Possible integration of ATC and the SAGE system will also be considered.

By using a combination of CAA and military long range radar the coverage will be extended north to the Portland-Augusta, Me., area, south to Cape Hatteras, N. C., and west to Blackstone, Va., Martinsburg, W. Va., Wilkes-Barre, Pa., and Schenectady, N. Y.

CAA Liberalizes Airport Aid Policy

Washington—A new policy calling for more liberal standards in the administration of the federal aid airport program has been prepared by the Civil Aeronautics Administration.

Major changes will be the elimination of the strict 3,000 annual passenger or 30 based aircraft standard and the restrictions against use of federal funds on terminal buildings.

Formerly, an airport had to meet the 3,000 passenger criterion in order to be eligible for federal aid. A more liberal standard will judge eligibility on the aviation needs of the community involved and will give the CAA considerable flexibility in deciding which communities should get government money for their airport projects.

Easing of the controversial prohibition against use of federal money for terminals will help communities in the development of their passenger and cargo handling facilities, although the CAA is expected to insist that money used for terminal construction and for other projects be primarily aimed at improving safety and efficiency.

The CAA has already programmed $20 million for Fiscal 1956. Still to be allotted is $42.5 million appropriated by Congress as part of the four-year $252 million program. CAA is expected to announce allocations shortly after Jan. 1.

Under the new program, CAA can make allocations for future years, but the program administrators will probably try to keep the majority of its projects on a one-year basis.

Along with the new flexible standards for airport eligibility, CAA will have standards for the development of new airports. New facilities will be eligible in cases where a community proves the need for one or where one airport could serve two or more cities better than separate facilities. Additional airports can be authorized for communities where existing facilities are inadequate or cannot be economically expanded. When an airport gets past the mark of 100,000 movements a year, a potential need for another airport exists.

ADC Interceptors Being Fitted With Falcon Air-to-Air Missiles

By William Coughlin

Yuma, Ariz.—Interceptor aircraft of the Air Defense Command soon will be equipped with the Hughes' Falcon GAR-1 air-to-air missiles, it was revealed at the close of the 1955 fighter weapons and rocketry meet.

Air Force interceptor pilots will begin training with the Hughes-built guided missiles here early next year.

USAF's current crop of interceptors, the North American F-86D, Lockheed F-94C and Northrop F-89D, will be equipped with rockets as well as Falcon missiles during the training programs.

Convair's F-102A, soon to be phased into the program, is designed to carry the missiles.

To provide targets capable of altitudes and speeds which will test the performance of the Falcon-equipped weapon systems, a squadron using Ryan Q-2 drones will be organized here within a few months.

"Certainly use of the drones will be expensive but so is the Falcon," said a high-ranking USAF officer.

Every Air Defense Command pilot will fire at least one, and possibly two, Falcons during his annual training period at Yuma AFB. Falcons will give the pilots a wider accuracy limit than the 2.75 folding fin rockets now in use.

Martin B-57 Canberras will phase into service here as target tow ships, further enabling interceptor pilots to fire in training at altitudes higher than is possible with the North American B-45s and Boeing B-29s.

Plans to step up training in both rockets and air-to-air missiles were revealed at the conclusion of a rocket meet which left official observers somewhat disappointed in the scores.

"We are not too good yet," commented Col. Robert F. Worley, commander of the training base.

First place in the rocket meet went to a team from Eastern Air Defense Force, flying Lockheed F-94C Starfires. EADF scored 11,600 points out of a possible 24,000.

In second place with 10,600 points was an Air Training Command team, flying North American F-86Ds. Northeast Air Command, flying Northrop F-89Ds, scored 9,000 for third. Results of the fighter weapons phase of the meet, held at Nellis AFB, Las Vegas, were reported in AVIATION WEEK, Oct. 10, p. 17.

Maintenance men said the Hughes Aircraft E-4, E-5 and E-6 fire control systems installed in the interceptors showed improvement over last year but "still had a long way to go" in reaching acceptable reliability.

Col. Worley estimated that the great majority of "misses" in the meet were due, not to errors on the part of the pilot or ground controller, but to inaccuracy or malfunctioning of the fire control systems. The low scores indicate this remains a considerable problem.

Air Force maintenance crews are a long way from mastering the intricacies of maintaining the fire control systems, he said.

Commenting on the Hughes system, he added: "As weapons go, this is still awfully new. We're still in the process tactically of learning to walk with it."

During the meet, interceptor pilots were required to go under the hood at 10,000-ft., make all firing passes "blind," and remain under the hood until returning to the 10,000-ft. level.

F-86Ds equipped with control system tie-in CSTI equipment had it wired off during the meet.

Firing was at 9 ft. x 45 ft. Radar reflecting nylon marquisette targets towed at 380 kts. true airspeed at altitudes of 18,000 and 30,000-ft. Aircraft were limited to 24 rockets on each mission.

"If the F-89 could fire 104 rockets, it probably would score 100 per cent," Col. Worley said.

Hughes Stepping Up Falcon Production

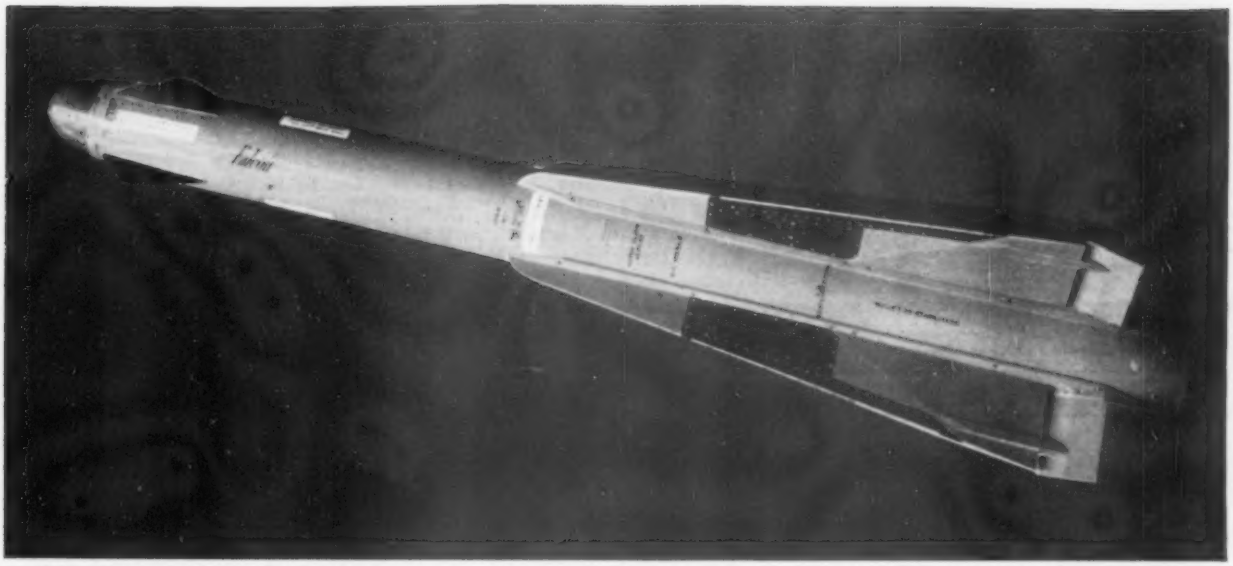
Tucson—Hughes Aircraft Co. is stepping up production of the USAF's Falcon air-to-air missile from its present rate, believed to be in excess of 100 per month, according to observations made during a recent visit to the Hughes plant here.

Present cost of the Falcon is estimated to be between $25,000 and $50,000 each. The figure is expected to drop to $10-15,000 within the next year or two.

Employment at the Hughes Tucson plant is nearly 4,400, 50% above last year.

It is scheduled to reach 5,500 by the end of 1956. Another indication that Falcon production is being increased significantly is the recent addition of 15 major subcontractors. When they reach full production late next year, subcontractors will supply nearly 50% of the Falcon production effort.

Despite the general stretchout of production in the avionics industry, Hughes Aircraft's employment, facilities and sales have increased since AVIATION



USAF'S FALCON AIR-TO-AIR MISSILE, now in sizable production at Hughes' Tucson plant, has built-in radar guidance system.

WEEK's original visit in 1953. The company now employs 19,000, up from 16,000, while floor space is up from 2.4 million to 3.1 million square feet.

Sales this year will run "somewhat more than $200 million," a company official said. The figure was slightly less in 1953.

These figures indicate that Hughes has recovered and stabilized from the management exodus which shook the company two years ago (AW Sept. 28, 1953, p. 15). Hughes reveals that it has produced more than 8,000 interceptor fire control systems at its main Culver City (Calif.) plant, 3,000 of which have been turned out since Jan. 1954. This equipment, widely reported in the daily press last week, was reported in AVIATION WEEK, beginning more than three years ago (Feb. 25, 1952, p. 69).

At that time AVIATION WEEK reported:

"The interceptor's radar will then track the target, providing . . . information (which) will be fed to a computer which instantly calculates what path the airplane should fly to intercept the target.

"Signals from the computer will go to the autopilot which will quickly maneuver the airplane onto the desired flight path."

"Much more advanced guided missiles than the Falcon are very close to production," a Hughes official said. These are under development at Culver City, although the company is transferring all missile production engineering functions to Tucson.

Special test equipment, developed by Hughes for checking Falcons under simulated flight conditions, cost $15 million, a million dollars more than the combined cost of the Tucson plant and its machine tools.

LEAVING THE NEST, a group of Falcons shown in shipping cases will be used for flight test purposes, as evidenced by telemetering antennas (silver strips) mounted on insulated portions of the wing. Reliable sources report that the Falcon missile is capable of operating well into the supersonic speed range.

USAF Orders F-104As

Burbank, Calif.—An order valued at more than $100-million for new F-104A jet fighters for the Air Force was received last week at Lockheed Aircraft Corp. The prototype XF-104 started its flight tests in February of 1954 and at present is flying at Edwards Air Force Base.

Congress Starts Study Of Automation Effects

A study of the effects of automation and technological developments on the financial structure of industry and labor requirements has been started by the Joint Congressional Committee on the Economic Report.

Hearings before a subcommittee headed by Rep. Wright Patman (D.-Tex.) have been scheduled for this week and next week. Witnesses to testify on automation in the electronics industry are Don Mitchell, president, Sylvania Electric Products; Robert C. Tait, president, Stromberg-Carlson Division, General Dynamics Corp.; and Cledo Brunetti, director, Engineering Research and Development, General Mills. Other witnesses include Vannevar Bush, president, Carnegie Institution; Ralph Cordiner, president, General Electric Co.; Sheldon Hall, vice president, Burroughs Corp., D. Z. Davis, vice president, Ford Motor Co.

Propeller Reversal Blamed in Crash

Crash of a United Air Lines' DC-6 shortly after take-off on a training flight from New York's McArthur Field Apr. 4 was probably due to the unintentional movement of one throttle into reverse range, according to Civil Aeronautics Board's accident investigation report.

With the other three engines operating at high power output, the aircraft quickly became uncontrollable once airborne, the report said.

Three pilots were killed: Capt. S. C. Hoyt, UAL New York area flight manager, in command, and Capts. V. H. Webb and H. M. Dozier, aboard for their periodic instrument proficiency check.

Evidence indicated that the one throttle was moved out of reverse by the pilot into the forward position in an attempt to unreverse, the report said, but the reverse warning flag was not lifted, resulting in increased reverse thrust. There was insufficient time and altitude for any pilot corrective measures to become effective.

Defense Dept. Top Contractor List 'Misleading,' Sen. Johnson Charges

Washington—The Senate Preparedness Investigating Subcommittee issued a list of the 100 largest defense contractors, charging that an earlier list released by the Department of Defense is "inaccurate" and "misleading."

Sen. Lyndon Johnson (D.-Tex.), chairman of the subcommittee, said that his group "feels a complete and accurate picture of these awards should be made available to the public."

He said the subcommittee concluded that the Defense Department report on the major contractors "made it impossible to determine who currently were the largest defense contractors and that methods used in collecting statistics clearly needed review and overhauling as a result of errors made in compilation."

Major difference between the two lists: Defense Department does not include General Motors Corp. as one of the top 100; the Senate subcommittee puts GM at the top of the list with over $6.6 billion in defense business. A supplement to the department report shows GM with a "minus" $58.9 million in defense business.

Forty-five other firms not found in the department's "100" list but appearing in the subcommittee's include Chrysler Corp., Westinghouse Electric Corp., Northrop Aircraft, McDonnell Aircraft Corp., and Bell Aircraft. On the Senate list Chrysler has the 10th largest volume of defense business; Westinghouse, 16th; Northrop, 18th; McDonnell, 25th; and Bell, 31st.

The main reason behind the difference is that the Defense list covers the period from mid-1953 through 1954 (AW May 30, p. 15), while the Senate list begins with the military mobilization program in mid-1950.

Defense Explanation

The Defense Department promptly denied the charge that its report of last May was misleading. Defense said that a "cover sheet on the 'analysis of large military prime contractors' May 16, 1955, states 'General Motors, for example, undoubtedly is still one of the largest suppliers of military equipment.' It is certain that many of the 45 companies are still among the largest suppliers in terms of current procurement.

"The companies referred to are large suppliers which were not listed on the report for the reason that cancellations and terminations partially or wholly offset new business awarded them during this period.

". . . The report was prepared in response to a specific request of Sen. Fulbright who expressed a particular interest in the awards to large suppliers during the 18-month period covered by the report. The information that cancellations for General Motors and other large suppliers exceeded new awards during the period was significant information and appropriate to Sen. Fulbright's study of the stock market."

Report 'Inconsistent'

"It is axiomatic," the Senate subcommittee maintained, "that any statistical series must be prepared on a consistent basis if it is to be of any real usefulness. Otherwise the data ceases to be of value for comparative purposes and much important information is lost or suppressed."

The Defense report was "inconsistent," the subcommittee complained, because while "purporting to cover only the 18-month period from mid-1953 through December, 1954, it did eliminate from the aggregate contracting totals for this period, cancellations of contracts awarded prior to the period."

The subcommittee also objected that by using mid-1953 as a starting point, the Defense list "produced a further misleading overall picture" by failing to show heavy procurements during the six previous months, starting January, 1953, when the Eisenhower Administration started. During this period, the report said, contracts were awarded to General Motors for $1.4 billion; to Boeing, $2.4 billion, and to General Dynamics, $1.1 billion.

Defense Department issued its report in mid-May because it was directed to do so by two congressional committees—Senate Banking and Currency Committee and the House Small Business Committee. The department had decided to discontinue the reports for "economy reasons" after issuing one for the mid-1950 to mid-1953 period in January, 1954. The listings of defense contractors had previously been issued every six months.

The Banking and Currency Committee, headed by Sen. William Fulbright (D.-Ark.), turned the department's report over to the Preparedness Subcommittee for evaluation.

Observing that "the distribution of defense contracts among producers has long been a subject of considerable interest, not only to the Defense Department and businessmen generally but also to Congress, other government agencies, and the general public as

100 LARGEST DEFENSE CONTRACTORS

This is the list of companies with the largest volume of military business prepared by the Senate Preparedness Investigating Subcommittee.

Rank	Company	Total Contracts	Terminations and Cancellations (In Millions)	Net Value
1	General Motors Corp	$7,471.1	$832.2	$6,638.9
2	Boeing Airplane Co	5,411.9	244.1	5,167.8
3	Douglas Aircraft Co., Inc	4,180.3	270.7	3,909.6
4	United Aircraft Corp	4,250.8	373.3	3,877.5
5	General Electric Co	4,048.9	376.4	3,672.5
6	Lockheed Aircraft Corp	2,971.0	78.1	2,892.9
7	North American Aviation, Inc.	2,888.2	46.4	2,841.8
8	General Dynamics Corp. (Consolidated Vultee) (X)	2,869.4	119.4	2,670.0
9	Republic Aviation Corp	2,236.9	29.7	2,207.2
10	Chrysler Corp	2,600.0	511.1	2,088.9
11	Curtiss-Wright Corp	2,092.6	6.3	2,086.3
12	American Telephone & Telegraph Co	1,916.0	160.7	1,755.3
13	Ford Motor Co	1,826.3	163.1	1,663.2
14	Grumman Aircraft Engineering Corp	1,463.8	43.1	1,420.7
15	Bendix Aviation Corp	1,185.5	30.3	1,155.2
16	Westinghouse Electric Corp	1,601.1	454.7	1,146.4
17	Sperry Corp (The)	1,137.9	47.3	1,090.6
18	Northrop Aircraft, Inc	1,070.0	81.8	988.2
19	Hughes Tool Co	993.6	57.9	935.7
20	Martin (Glenn L.) Co	930.8	11.2	919.6
21	Kaiser Motors, Inc	926.6	25.1	901.5
22	Studebaker	583.2	102.0	
	Packard	442.7	102.7	821.2
23	Radio Corporation of America	823.1	82.7	740.4
24	American Locomotive Co	847.9	143.0	704.9
25	McDonnell Aircraft Corp	883.9	191.8	692.1
26	International Harvester Co	771.8	134.8	637.0
27	Goodyear Tire & Rubber Co	573.2	30.5	542.7
28	Fairchild Engine & Airplane Corp	568.6	27.3	541.3
29	International Telephone & Telegraph Corp	611.5	85.5	526.0
30	Avco Manufacturing Corp	544.4	22.0	522.4
31	Bell Aircraft Corp	630.4	136.8	493.6
32	Du Pont (E. I.) de Nemours Co	637.7	146.8	490.9
33	Olin Industries Inc	532.9	50.2	482.7
34	Eastman Kodak Co	501.3	19.9	481.4
35	Hercules Powder Co	456.5	23.8	432.7
36	Firestone Tire & Rubber Co	450.6	21.5	429.1
37	American Motors (Nash-Kelvinator Corp.)	427.0	12.9	414.1
38	Philco Corp	450.8	46.5	404.3
39	International Business Machine Corp	430.3	38.6	391.7
40	Bethlehem Steel Corp	377.2	.7	376.5
41	Newport News Shipbuilding & Dry Dock Co	374.1	.1	374.0
42	Raytheon Manufacturing Co	376.0	6.7	369.3
43	Standard Oil Co (New Jersey)	367.4	16.3	351.1
44	Collins Radio Co	361.2	19.6	341.6
45	Piasecki Helicopter Corp	323.9	5.3	318.6
46	Reo Motors, Inc	333.8	29.2	304.6
47	Standard Oil Company of California	307.4	6.2	301.2
48	United States Rubber Co	308.0	9.5	298.5
49	Food Machinery & Chemical Corp	324.2	29.3	294.9
50	Continental Motors Corp	309.8	18.3	291.5
51	American Car & Foundry Co.	375.9	84.5	291.4
52	Stevens & Co., Inc	283.3	.1	283.2
53	American Woolen Co	277.8	.8	277.0
54	United States Steel Corp	281.2	10.4	270.8
55	Beech Aircraft Corp	258.5	3.5	255.0
56	General Tire & Rubber Co	263.5	17.2	246.3
57	Federal Cartridge Corp	276.0	33.3	242.7
58	Swift & Co	222.2	.1	222.1
59	North Atlantic Constructors	217.5		217.5
60	Rheem Manufacturing Co	220.3	18.5	201.8
61	Armour & Co	198.5	.1	198.4
62	Minneapolis-Honeywell Co	207.4	13.8	193.6
63	Hazeltine Corp	213.9	22.8	191.1
64	Remington Rand, Inc	190.4	.2	190.2
65	Sylvania Electric Products, Inc.	198.9	13.7	185.2
66	American Bosch Corp	190.0	5.6	184.4
67	Norris-Thermador Corp	183.1	4.3	178.8
68	United States Hoffman Machinery Corp	188.0	12.5	175.5
69	Ingalls Iron Works Co	174.1		170.5
70	New York Shipbuilding Corp	173.7	8.1	165.6
71	Bath Iron Works Corp	165.4		165.4
72	Mason Co	179.7	16.8	162.9
73	American Machine & Foundry Co	162.3	2.8	159.5
74	Massey-Harris Co., Ltd	161.1	2.7	158.4
75	Phillips Petroleum Co	160.0	2.2	157.8
76	Allis-Chalmers Manufacturing Co	177.0	20.7	156.3
77	National Gypsum Co	202.3	46.6	155.7
78	Cities Service Co	155.3	.8	154.5
79	Gilfillan Bros., Inc	153.1		153.1
80	Motorola, Inc	161.0	8.0	153.0
81	American Smelting & Refining Co	156.1	5.4	150.7
82	Goodrich (B. F.) Co	153.6	3.6	150.0
83	Burlington Mills Corp	146.4		146.4
84	Admiral Corp	152.0	6.4	145.6
85	Baldwin-Lima-Hamilton Corp	154.2	9.6	144.6
86	Sinclair Oil Corp	145.0	1.6	143.4
87	Borg-Warner Corp	167.2	24.2	143.0
88	Pacific Car & Foundry Co	162.8	19.9	142.9
89	Caterpillar Tractor Co	132.0	2.9	129.1
90	American Steel Foundries	128.4	.2	128.2
91	Stewart-Warner Corp	128.7	4.1	124.6
92	Diamond T Motor Car Co	178.4	59.4	119.0
93	Procter & Gamble Co	145.2	28.9	116.3
94	Sun Oil Co	114.3		114.3
95	American Safety Razor Corp	134.1	20.5	113.6
96	Bowen & McLaughlin Co	114.5	2.6	111.9
97	Mack Trucks, Inc	140.1	29.7	110.4
98	Day & Zimmerman, Inc	134.0	23.8	110.2
99	Fruehauf Trailer Co	127.1	18.9	108.2
100	National Cash Register Co	147.0	46.6	100.4

(X) Companies merged in 1954. Total figures include all Convair procurement, but does not include all of the procurement of General Dynamics Corp. for the period.

well," the committee recommended resumption of regular release of lists of 100 top contractors by Defense Department, using mid-1950 as starting point.

The subcommittee observed: "The pattern of distribution of defense contracts has important implications in many different directions. The concentration of contracts may tend to affect the forces of competition and to alter the relative positions of competing units. In some cases competition may be strengthened; in others there may be tendencies toward creation of restraints of trade or monopolies . . ."

House Majority Leader Rep John McCormack (D.-Mass.) in another attack, declared (AW July 4, p. 11):

"I would think that the former chairman of the General Motors Corp. would have been hurt at this drop in rank and prestige with his well-known economic-political philosophy that 'what is good for what'. When I read the report my heart really went out in sympathy for GM. I would not understand why Charles Wilson as Secretary Wilson should discriminate against this company. But as we view the real statistics, the picture is different."

NBAA May Finance Development Of Modern Executive Transport

By Erwin J. Bulban

Detroit—The National Business Aircraft Assn.—irked by what it considers the "foot-dragging" tactics of U. S. aircraft manufacturers—is thinking of underwriting the development of a high-speed transport especially designed to fill executive needs.

The problem of just how to get modern executive planes off the drawing boards and into the air will be the first agenda item to come before the association's new executive advisory committee at its initial meeting in New York City early in December.

The committee is composed of 15 executives of several U.S. corporations.

Henry W. Boggess, who was re elected president of the association at the meeting, said the committee would have no difficulty in raising the large sums needed to subsidize the development of a transport prototype.

Boggess also revealed a plan to decentralize NBAA activities in order to deal with on-the-spot local problems, particularly those relating to airports, more effectively.

Industry Interest

Despite unfavorable flying weather, official registrations at the annual meeting totaled 517, the largest in NBAA's history, (435 showed up at Dallas last year and 237 appeared at the 1953 meeting in St. Louis). The association also reported a 21% increase in membership since its Dallas meeting last year, for a total of 323 corporate members operating 850 planes.

Industry interest in this sizable and fast-growing market was indicated by the representation of approximately 70 firms at the meeting.

The increased competition for the business plane owner's dollar was evident from the displays by North American Aviation, Inc., and Fairchild Airplane Division of new turbine-powered transport proposals. Representatives of the firms were busy collecting pilot and owner opinions on various design and operating features of their proposals. The NBAA question, however, was when, and if, these planes would leave the drawing board.

North American showed turboprop and turbojet powered designs with these common features:

Eight-passenger normal seating capacity (15 passengers in the high-density version); cabins pressurized to equivalent of 8,000 ft.; 1,500-statute-mile range; tricycle landing gear; thermal anti-icing for wings and tail, and 75-in. standup head-room. The airplane's size was said to fall between that of the Lockheed Lodestar and Douglas DC-3.

The placard accompanying the display said the planes could be available to purchasers 30 months after the firm received a go-ahead to produce.

The turboprop design was planned around two Rolls-Royce Darts and would have a gross weight of 21,500 lb. Operating altitude would be 30,000 ft. Initial cost was given as $450,000 and operating cost for 1,000 hr. at $60/hr.

North American's turbojet showed a gross weight of 36,300-lb., an operating altitude of 43,400 ft., initial cost of $550,000 and direct operating cost of $130/hour.

However, industry observers at Detroit noted that North American reportedly has designed a highspeed twinjet trainer for the Air Force which could push development of the business plane studies aside at least temporarily.

Fairchild's Design

Fairchild's new project, a development of the M-225 proposal (AW July 25, p. 16; Aug. 15, p. 122), showed some changes over the original design.

The company has increased the wing area from 250-sq.-ft. to 325-sq.-ft. to increase jet fuel stowage and provide over 5,000 gal. internally. With additional external fuel, the new M-225 could carry 7,300 gal.

An important change is planned in the powerplant layout. Originally scheduled for four jets in the Fairchild J44 class, the new proposal would have three engines, all placed in the tail. Company spokesmen refused to talk about the new powerplants except to say that they are military types still in the MX-number state.

To get the airplane off to an early flight test program prior to availability of the new MX-type engines, the prototype will be powered by two Westinghouse J34s totaling 7,200 lb. thrust, an indication of the approximate thrust of the advanced powerplants planned.

Industry observers at Detroit reported that Ryan Aeronautical Corp. is another contender in the turbine-powered executive transport field. Republic Aviation Corp. is also mentioned as having finalized a DC-3-size design powered by two Rolls-Royce Darts.

Company officials said they now have orders for some 40 Rato installations to date, many of them for business aircraft.

Forum Discussions

Safety awards keynoted the sessions. Recognition of flight safety records achieved by corporations and pilots pointed up the heavy flying activity by U.S. companies. The awards included:

- **John P. Gaty,** vice president-general manager, Beech Aircraft Corp., Wichita, Kan., received the 1954 Annual Business Flight Safety Award of the Women's Aeronautical Association of Kansas. Presented for the first time, the silver cup recognized Gaty's safety promotion efforts since 1934.
- **Million-miler safety awards** were given 15 officers of NBAA-member corporations, who have flown a total of 18,179,225 plane-miles without accident.
- **500,000-or-more-mile safety awards** were granted 54 NBAA-member pilots who have accumulated a total of 37,606,770.5 accident-free plane-miles.
- **Meritorious safety awards** were given 19 member corporations whose aircraft have one million or more accident free miles. These represented a total of 35,450,367 safe plane-miles.

The need for exchanging information relating to administrative, maintenance and operating problems was indicated by the heavy emphasis on these phases of business plane operations.

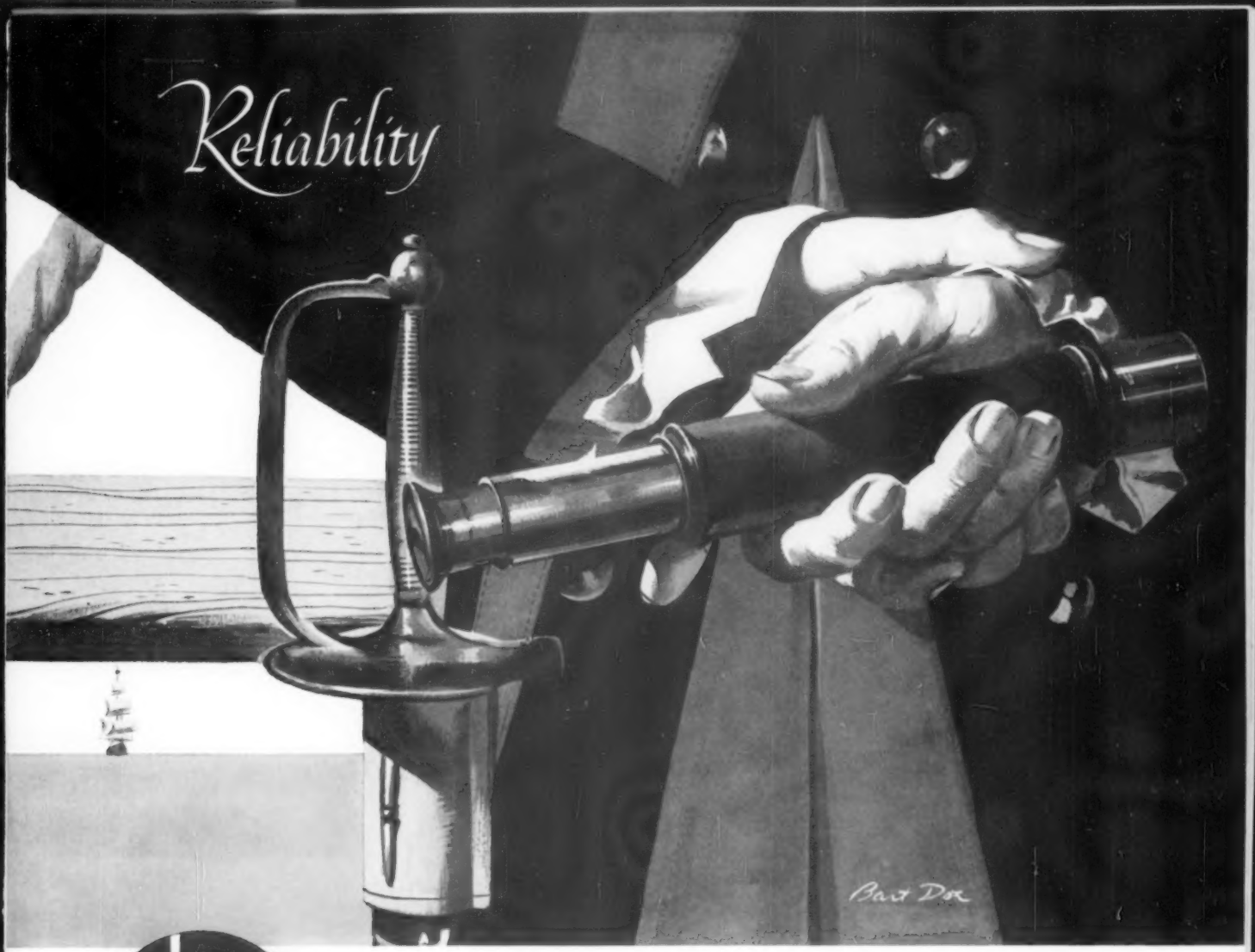
It was obvious that because of the individualistic operations of hundreds of business aircraft operators using a wide variety of greatly modified aircraft, there is a big need for standardizing overhaul requirements if costs are to be reduced.

Fixed base operators said that, with labor costs running about $4.50/hour, they are lucky to make three percent profit after taxes. Many pilots complained that aircraft down-time often greatly overran initial estimates.

The maintenance representatives said that one of their big problems is getting a detailed specification from the plane owner sufficiently in advance to schedule stocking of parts. One maintenance operator said that some DC-3 and Lodestar items now take 60-120 days to procure. Another said he thought that he should have detailed specifications on the work to be done on an airplane a minimum of 120 days before the craft arrived at his shop.

In addition to the re-election of Boggess as NBAA president, Walter C. Pague, Armco Steel Corp. captain, was named national vice president. Gerald J. Eger, International Harvester Co., was re-elected treasurer and Jean DuBuque was re-elected executive director-secretary.

New members of the board: Curtis G. Talbot, General Electric Co., and Robert Sprague, Jr., Sprague Electric Co.



Rheem

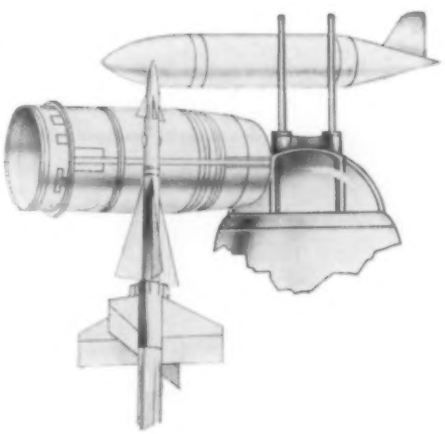
GOVERNMENT PRODUCTS DIVISION

Just as success sailed with John Paul Jones on the thundering, blood-soaked decks of *The Ranger* and *The Bon Homme Richard*, so in every major conflict to this day has victory crowned the valor of our fighting men.

Reliability in men and machines was, and is, the security of our nation.

At Rheem, we, too, are proud of the reliability of our men and machines and the enviable record of low per-unit cost and on-time completion schedules amassed in our role as prime contractor to the United States Government and sub-contractor to other industry leaders.

The Government Products Division facilities of Rheem are presently in quality development and production on air frames, missile and jet-engine components, airborne ordnance, electronics and ordnance materiel.



YOU CAN RELY ON RHEEM

Rheem Manufacturing Company • GOVERNMENT PRODUCTS DIVISION

DOWNEY, CALIF. • SAN PABLO, CALIF. • WASHINGTON, D.C. • PHILADELPHIA, PA. • BURLINGTON, N.J.

Secured

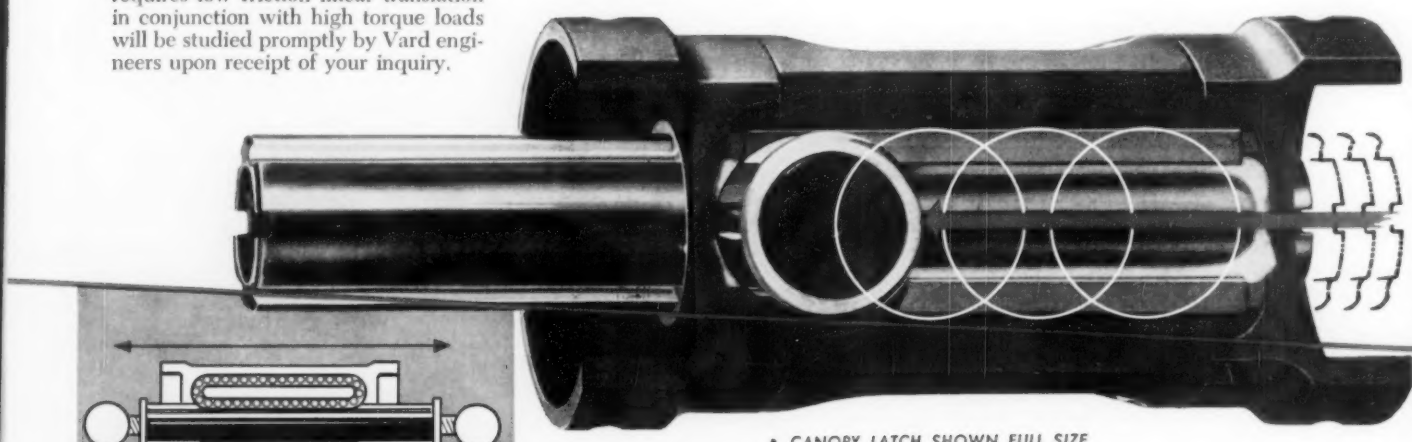
Vard's extensive experience in the field of low friction ball-type mechanisms has yielded a solution to an entirely new problem in the Douglas B-66 canopy latch application.

The ball-spline type mechanism shown below was devised to solve a problem where low friction linear motion was required concurrent with the application of very high torque loads.

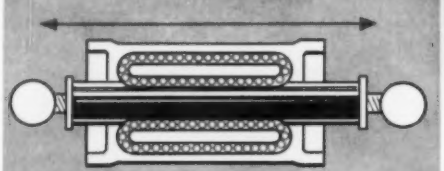
The thirteen Vard designed and built canopy latch units used in the Douglas B-66 permit an efficient method for accomplishing the diverse requirements of simple manual operation, effective sealing for pressurization and accommodations for emergency ejection.

Your mechanical application which requires low friction linear translation in conjunction with high torque loads will be studied promptly by Vard engineers upon receipt of your inquiry.

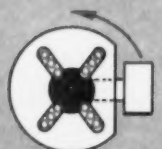
The Douglas B-66 shown above is the U. S. Air Force's latest twin jet bomber. First flown in June, 1954, this airplane plays an important part in the new concept of Tactical Air Operations.



• CANOPY LATCH SHOWN FULL SIZE



CLOSED CIRCUIT LINEAR BALL SYSTEM



FOUR WAY SPLINE PERMITS LOW LINEAR FRICTION UNDER HIGH TORQUE LOAD

FIRST in mechanical actuation

Resident Sales Engineers:
New York City Dayton, Ohio

VARD

2981 EAST COLORADO STREET, PASADENA 8, CALIF.

Federal Contractor Policy Scored

Washington—The Defense Department's order to limit contractor payments to 105% of incurred costs (AW Sept. 26, p. 18) actually is "an effort to dodge the shortcomings of government internal contract administration," the National Security Industrial Assn. has charged.

The Department's aim, to cut back on the need for substantial refunds when price revision shows a contractor has collected more than his product is worth, could be achieved by simple contract changes, according to NSIA. At the same time, NSIA said, this system would avoid financial and administrative hardships that will result from the department's directive that went into effect last month.

NSIA Objections

In a letter last week to Reuben T. Robertson, Jr., Deputy Secretary of Defense, NSIA raised these objections to the directive:

- **It will leave** the government nearly always in debt to the contractor.
- **It is arbitrary and inequitable,** adds to the accounting burden, deprives the contractor of needed funds.
- **It will not speed** the repricing procedure, which now takes more than a year because of administrative delays by the customer.
- **It is impossible** for most contractors holding price-revision or incentive-type contracts to certify their costs on day-to-day basis.
- **It is feared** that the effect of the directive will be to convert fixed-price contracts into cost-type contracts, thus increasing auditing and administrative work.
- **It is feared** that the process of getting a price-revision amendment to a contract will take longer when additional payments usually are due the contractor.

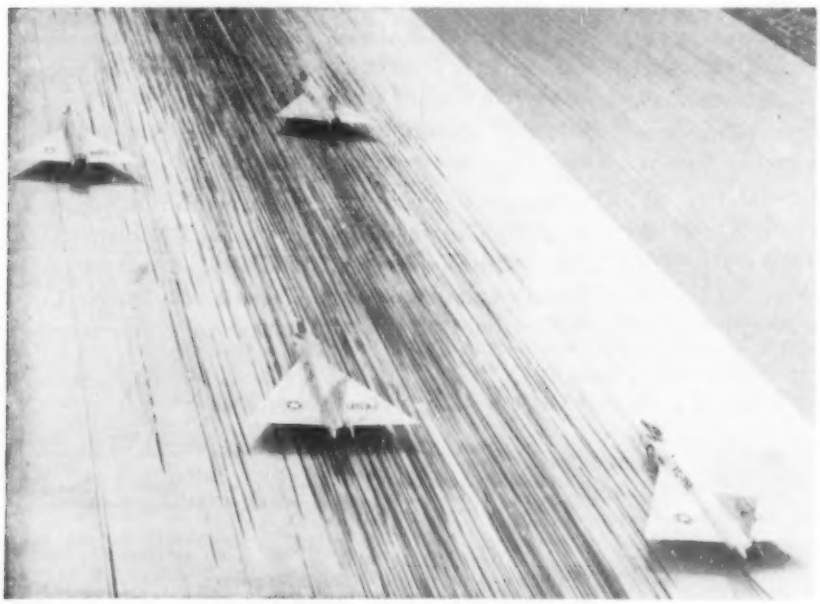
In a letter to Robertson, NSIA said that the September directive is similar to a Navy instruction issued last July. The organization, which maintains liaison between industry and the Defense Department and offers advice on industrial experience and practices, had discussed the problem with the Navy and prepared a study for submission to N. P. Cassidy, Assistant Navy Comptroller. In view of the Defense Department's action, the report, was sent to Robertson.

Faster Action Urged

NSIA said it does not disagree with the objective, but fears that the government action "represents a drastic overcorrection."

"Our study of the problem," it said, "has indicated that the principal reason for existing delays in making refunds to the government after final determination of prices is the government's inability to put through price-revision amendments.

"We believe that most of what the government desires could be achieved



F-102As at Palmdale

FOUR CONVAIR F-102A jet interceptors line up for takeoff on runway at Palmdale, Calif. Illusion of speed comes from the hundreds of tire streaks left on concrete by landing aircraft. F-102As are undergoing production flight tests at Palmdale.

advanced technique

AVIONICS

guided missile instrumentation by AVION

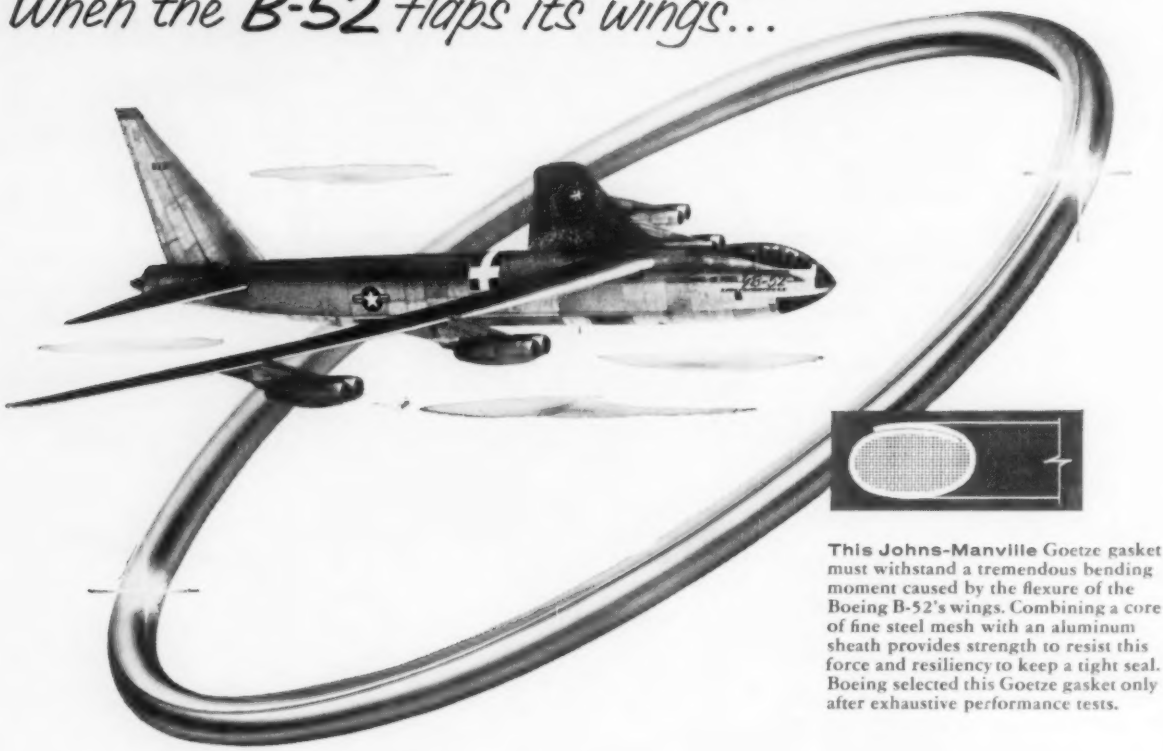
Subminiature radar beacons of extreme ruggedness for
X—Band
C—Band
S—Band
Developed by AVION for the Signal Corps, these beacons feature selective receivers and pulse decoders to assure interrogation reliability.

Avion's flexibility and ingenuity, coupled with extensive experience in Electronics, Mechanics and Optics can better serve you.

Investigate the career opportunities in our expanding organization.

AVION
INSTRUMENT CORP.
SUBSIDIARY OF ACF INDUSTRIES, INC.
299 Highway No. 17, Paramus, N.J.

When the B-52 flaps its wings...



This Johns-Manville Goetze gasket must withstand a tremendous bending moment caused by the flexure of the Boeing B-52's wings. Combining a core of fine steel mesh with an aluminum sheath provides strength to resist this force and resiliency to keep a tight seal. Boeing selected this Goetze gasket only after exhaustive performance tests.

Johns-Manville Goetze Gaskets

maintain a tight seal in pneumatic duct system

THIS critical sealing problem was solved for Boeing with a special gasket, designed and engineered by J-M Goetze Gasket technicians.

Problems like this are typical of today's modern aircraft. Temperatures are higher! Pressures are greater! Flanges are lighter! Every day, Goetze technicians are proving Goetze metal gaskets' ability to meet these exacting demands. Every day more designers are turning to Johns-Manville for help in their sealing problems.

For more than 60 years, Goetze has pioneered the development of metal gaskets. Today, thousands of precision-made styles and sizes are available. Goetze Gasket experts will be glad to help you select the one that best meets your needs. Or they will custom-design something new, tailor-made to your specific requirements.

Write today for further information on Johns-Manville Goetze Gaskets and other J-M products for aviation. Ask for Brochure AV-1A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

THERE'S A J-M GASKET FOR EVERY SEALING PROBLEM

Spirotallic | Corrugated Metal | Screen | French Type | Single Bead | Mesh Filled | Non-Metallic

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville** PRODUCTS FOR THE AVIATION INDUSTRY

by faster internal administration. However, we also have in mind that another related purpose of the government is 'to facilitate timely adjustment of provisional billing prices.' We think that both of these objectives can be achieved without unduly penalizing contractors by relatively minor alterations in the price-revision technique."

Basically, NSIA said, they recommend that contract redetermination clauses "require both the refunding of excessive payments and the reduction of current billing prices at an earlier date in the life of the contract." NSIA believes the new prices should be put in effect at once when they are determined, without waiting for the pertinent contract amendment.

The report to Robertson includes suggested changes in both the Form IIB Price Redetermination Clause used by the Air Force and the contract form used by the Navy.

Pratt & Whitney Gets Certificate of Necessity

Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn., has been granted a $1,712,000 certificate of necessity for military aircraft engines by the Office of Defense Mobilization with 65% of the amount allowed for rapid tax amortization.

Other recent certificates include:

Bell Aircraft Corp., Wheatfield, N. Y., military aircraft, $132,774 certified with 65% allowed, military aircraft, $15,000 certified with 60% allowed; Ft. Worth, Tex., military aircraft, $9,179 certified with 65% allowed.

Ryan Aeronautical Co., San Diego, Calif., military aircraft assemblies, $140,000 certified with 60% allowed; aircraft parts, $50,000 certified with 60% allowed.

R. H. Freitag Manufacturing Co., Akron, Ohio, military aircraft parts, $202,352 certified with 70% allowed.

Parker Aircraft Co., Los Angeles, Calif., aircraft parts, $221,150 certified with 70% allowed.

Ex-Cell-O Corp., Highland Park, Mich., aircraft parts, $146,287 certified with 65% allowed.

McDonnell Aircraft Corp., St. Louis, Mo., military aircraft, $55,000 certified with 60% allowed.

Lord Manufacturing Co., Erie, Pa., aircraft engine parts, $97,417 certified with 65% allowed.

Sanitary Scale Co., Belvidere, Ill., aircraft parts, $17,443 certified with 70% allowed; aircraft parts, $11,205 certified with 70% allowed.

Fairchild Engine and Airplane Corp., Stratos Division Bay Shore, N. Y., aircraft parts, $85,305 certified with 65% allowed.

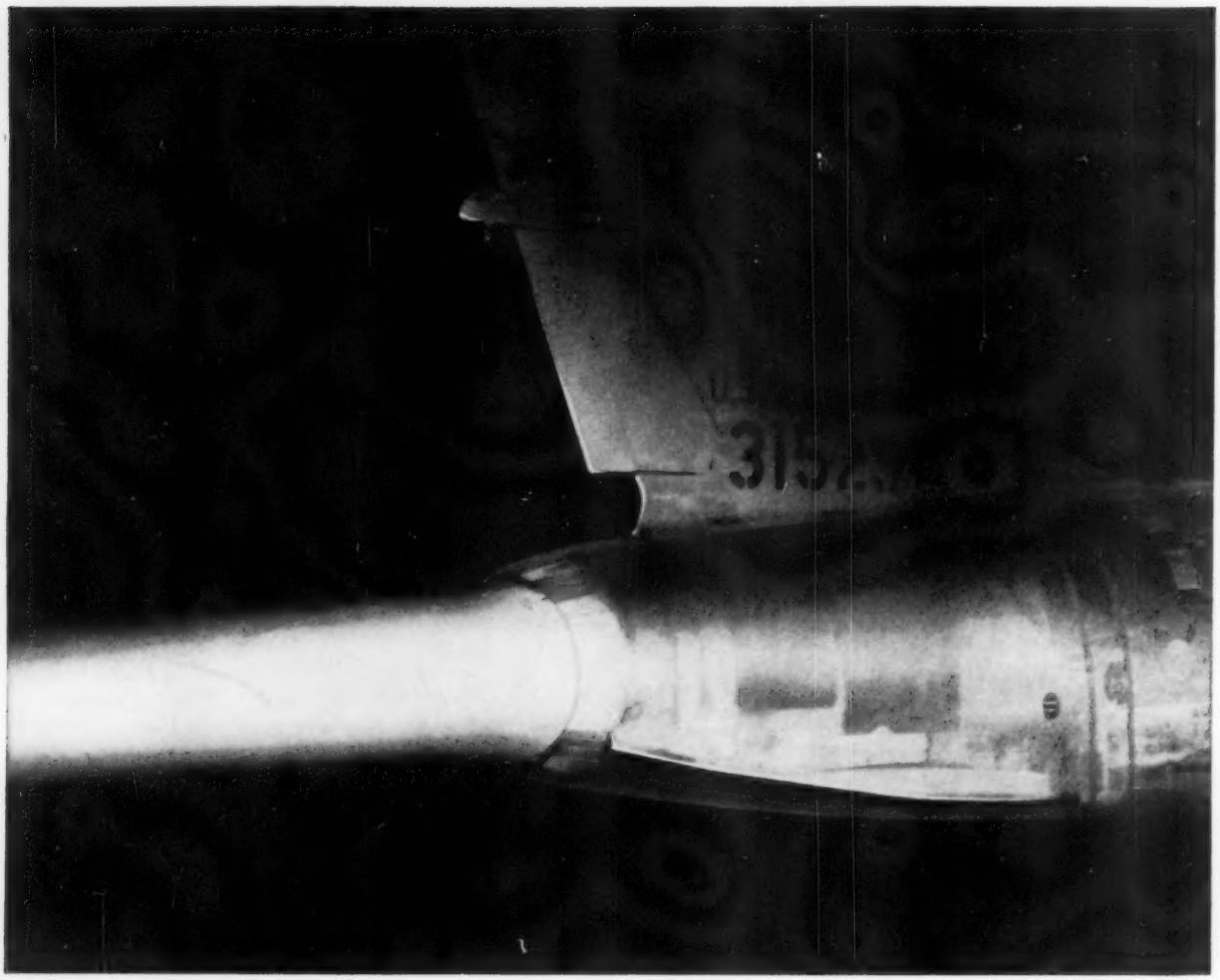
Southwest Airmotive Equipment Co., Dallas, Tex., military engine overhaul facilities, $580,388 certified with 60% allowed.

Air Transport Manufacturing Co., Los Angeles, Calif., military aircraft parts, $15,505 certified with 70% allowed.

Bendix Aviation Corp., Pacific Division, North Hollywood, Calif., aircraft components, $83,126 certified with 65% allowed.

Allegheny Ludlum Steel Corp., Brackenridge, Pa., titanium processing facilities, $1,590,000 certified with 75% allowed, Watervliet, N. Y., titanium processing facilities, $307,000 certified with 65% allowed; Dunkirk, N. Y., titanium processing facilities, $397,000 certified with 65% allowed.

Power Packed
Crusader!
CHANCE VOUGHT XF8U-1
"CRUSADER"
Like a deadly silver arrow leaving the bow the trim airframe of the Navy's XF8U-1 accelerates quickly to supersonic speeds . . . Titanium saves pounds, and turbojets provide super power for an exceptional combat ceiling and penetration of the speed of sound in level flight!
Camloc ¼-turn and SPF fasteners on strategic panels and doors throughout the plane fulfill the need for safety in flight, quick access on deck.
CAMLOC
FASTENER CORPORATION
22 Spring Valley Road, Paramus, N. J.
WEST COAST OFFICE: 5410 WILSHIRE BLVD., LOS ANGELES, CAL.



Tail section of North American F-100

vacuum-melted metals for "hotter" engines...

Vacuum-melted metals are breaking the "thermal-metal-barrier" of jet engine design. For they make possible higher engine operating temperatures, under conditions where conventional alloys fail rapidly.

Turbine blades of vacuum-melted superalloy, for example, were tested together with comparable blades of air-melted alloy. After 40 hours of operation the air-melted blades broke when bent less than 90° . . . the vacuum-melted blades took a full 180° bend without failure! For main shaft ball bearings, too, vacuum-melted metals far outperform conventional alloys.

Here's why . . . VACUUM MELTING LITERALLY SUCKS GASEOUS IMPURITIES FROM THE MOLTEN METAL...REMOVES INCLUSIONS AND GASSES THAT LIMIT THE PERFORMANCE OF CONVENTIONAL AIR-MELTED ALLOYS. RESULT: PURER METALS WITH EXCEPTIONAL PROPERTIES . . . LONGITUDINAL AND TRANSVERSE UNIFORMITY . . . HIGHER CREEP AND STRESS RUPTURE STRENGTH...BETTER DUCTILITY AND FATIGUE STRENGTH.

Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing these unique new metals designed for a wide variety of aircraft applications. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write *Vacuum Metals Corporation, P. O. Box 977, Syracuse 1, New York.*

VMC

VACUUM METALS CORPORATION

Jointly owned by Crucible Steel Company of America and National Research Corporation

Hawaii Airline Studies Fokker Turboprop

Trans-Pacific Airlines, Hawaiian Islands operator, has announced that it is considering the purchase of two or three turboprop-powered Fokker F. 27 Friendship transports as replacements for its DC-3s.

David A. Benz, TPA executive vice president and Olen V. Andrew, operations manager, recently returned from Europe where they studied current DC-3 replacements including the 40-passenger F. 27 and the Aviation Traders Accountant.

Benz said that, although no firm decision has been reached by the airline on purchasing either of the planes, he and Andrew will return to Europe sometime early next year to be on hand to watch the initial flight trials of the Friendship transport.

The new transport plane is scheduled to be available to operators in 1957, TPA's target date for modernizing its current fleet.

Trans-Pacific plans to buy new planes with funds from the sale of its DC-3s.

Officials of Bonanza Air Lines, Inc., with headquarters in Las Vegas, also have announced their interest in the Fokker Friendship. Edmund Converse, Bonanza president, plans to inspect the Friendship and has said that the plane "may be the solution to the local-service airlines' problem."

Skymotive to Open New Service Terminal

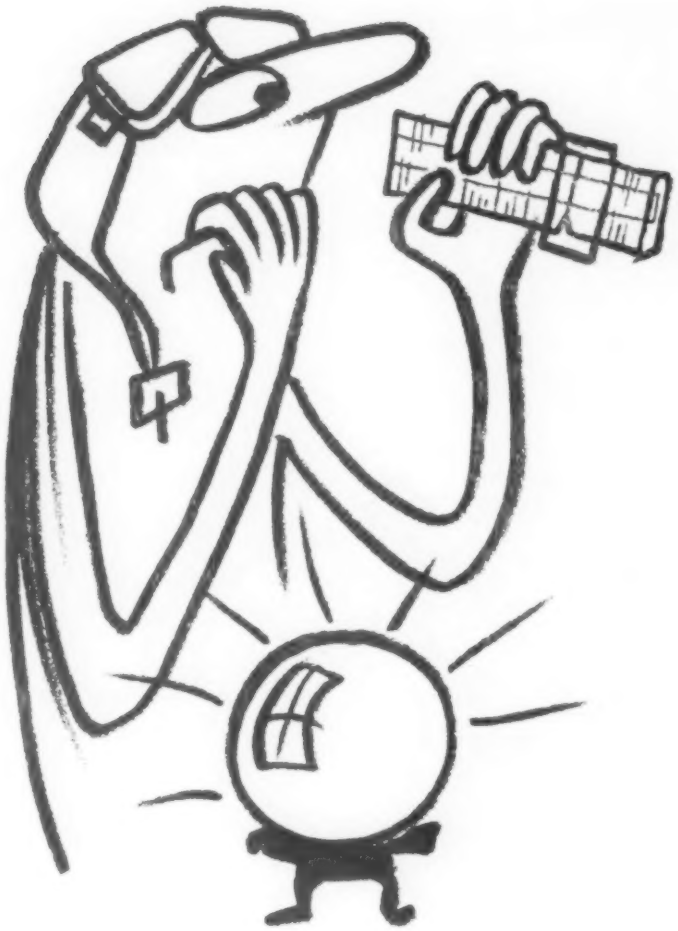
A new business aircraft operations and maintenance terminal centered around a recently-completed 125-ft. x 400-ft. partial cantilever hangar will be opened by Skymotive, Inc. at O'Hare Field-Chicago International Airport on Oct. 19.

Skymotive has obtained a 20-year lease on the area around its new quarters—enough to more than double the size of its present facilities—for possible expansion.

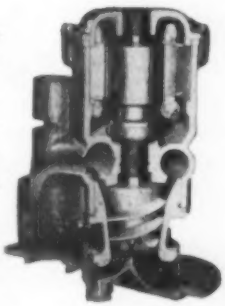
The terminal operator reports that it already has more than a dozen corporations leasing space in the facility, which includes a CAA-approved repair station, airframe, Class I & III, no limitation; radio, Class I & II, no limitation.

The new airport will be opened officially for airline use October 30th, when major carriers will transfer operations from Chicago's congested Midway Airport.

. . . . Useful, Complete, Comprehensive . . . .
Aviation Week Buyers' Guide, Nov. 28



design predictability



Trying to firm up new fuel pump specs? Well, stop staring at your slide-rule...call Hydro-Aire right now. The performance of our HY-V/L* Fuel Booster Pump is as predictable as ants at a picnic. We'll show you a simple chart method that'll pull the clouds out of that crystal ball.

Yes, the HY-V/L can be *tailored* to your specific needs. And that has already been done by such customers as Chance Vought, McDonnell, North American and Douglas.

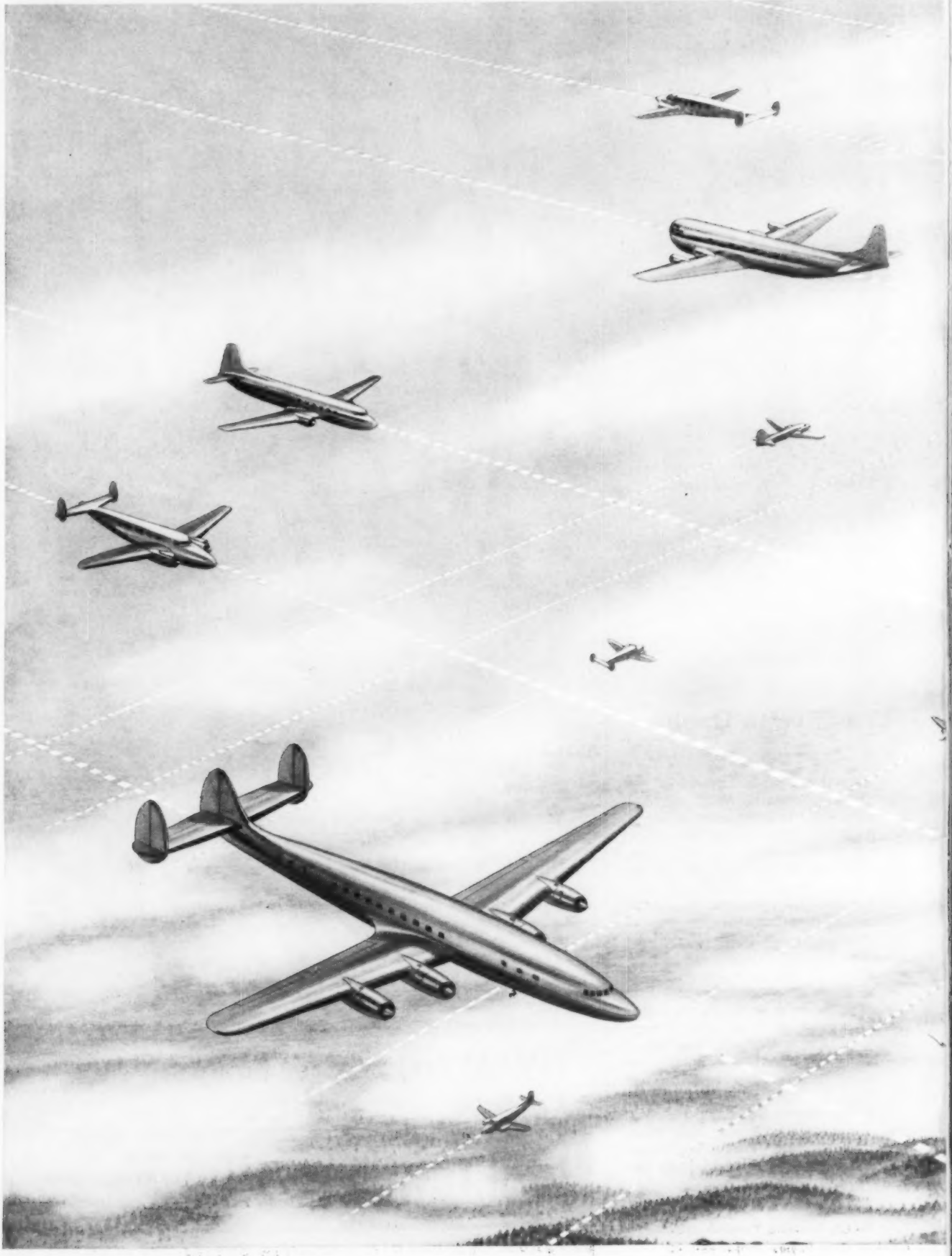
HY$^{V}/_{L}$* fuel booster pumps

*VAPOR/LIQUID RATIO

a product of

HYDRO-AIRE *Inc.* *who also make*
FUEL VALVES • TURBO MACHINERY
HOT AIR VALVES • *hytrol*

BURBANK, CALIFORNIA • *Aviation Subsidiary of* CRANE CO.



More room in the sky

...through

TACAN

revolutionary IT&T development

...providing multiple airlanes instead of one!

This remarkable system can virtually make the sky as much as "ten times wider."

Now *parallel* all-weather airlanes can be marked off in the sky by electronic means...airlanes that lie side by side, only a few miles apart, yet never meet. This can now be accomplished through a computer which derives its information from a single airborne "package" that measures the distance to a known ground station and determines bearing with pinpoint accuracy.

Thus, in heavily-traveled areas, multiple and accurate routes can be provided for aircraft to fly safely and efficiently, maintaining heavy traffic schedules in adverse weather.

TACAN is the result of a series of development programs sponsored by the U. S. Navy and the U. S. Air Force at Federal Telecommunication Laboratories, a division of IT&T. Federal Telephone and Radio Company, division of IT&T which now manufactures the military version of TACAN, will also manufacture and market the commercial aircraft and private flier versions of the equipment.

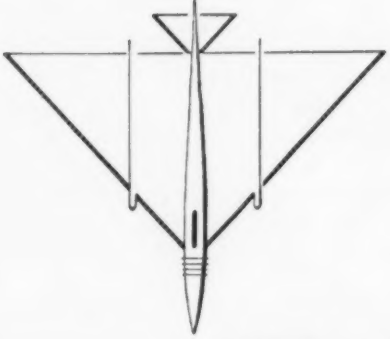
IT&T

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

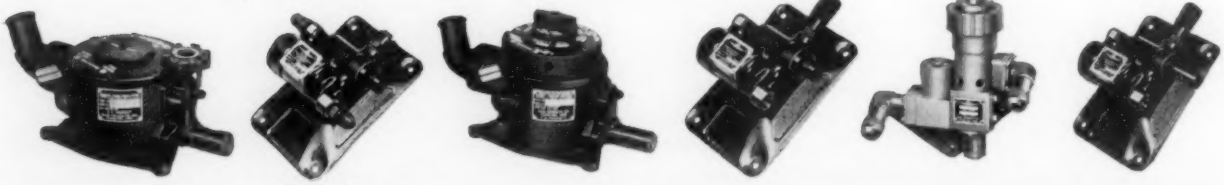
67 Broad Street, New York 4, N. Y.

crewmen *breathe easy...*

with ALAR AUTOMATIC OXYGEN REGULATORS



They breathe freely and think clearly . . . in planes equipped with Alar. Because regardless of the altitude, Alar Regulators automatically supply the oxygen needed to properly maintain muscular and mental coordination. Manufactured in a full range of models to meet every requirement . . . Alar regulating instruments are precision made to insure absolute dependability . . . and field proven by millions of hours under all types of flying conditions. So whether your design calls for oxygen regulators to serve a crew of one or a dozen . . . or a plane-load of passengers . . . they'll "breathe easy" when you specify Alar. Write for illustrated catalog today.



Specialists in the design and development of dependable pressure regulating instruments

ALAR PRODUCTS • INC.

1071 POWER AVENUE • CLEVELAND 14, OHIO

CAB Proposes Pacific Mail Rate

Final service mail rate for Pacific operations of Pan American World Airways and Northwest Airlines have been proposed by the Civil Aeronautics Board.

The proposed rates are based on equalization of mail rates on competitive route segments.

The Post Office Department will save $5.9 million in the year ending Mar. 31, 1955, compared with mail pay due under the old rate of 67 cents a ton-mile.

The new rates are calculated to yield an average of 41.74 cents a ton-mile for Pan American and 46.32 cents a ton-mile for Northwest on system-wide mail operations. They are effective Apr. 1, 1955.

CAB set a rate of 51.77 cents a ton-mile for Northwest and Pan American for all Pacific services during 1954. In the period Jan. 1, 1955 to Mar. 31, 1955 the two carriers would be paid 46.76 cents a ton-mile.

CAB is sticking to its decision to apply a standard mileage for trans-Pacific mail pay of 5,078 miles. This is the actual distance on Northwest's great circle route, and PAA objects strongly to the standardization since it has to fly a route that is 1,600 miles longer.

The Board says it can find no sound economic reason for charging the Post Office Department a different rate for transportation of mail between Tokyo and the United States for different routings.

The Board points out that passengers pay the same fare whether they fly Pan American or Northwest, and the same principle applies to cargo.

The proposed rates have been determined through a ratio technique. CAB applies the ratio between Northwest and PAA mail costs and the costs of the Big Four domestic carriers—American Airlines, Eastern Airlines, to the mail rate average yield for these carriers.

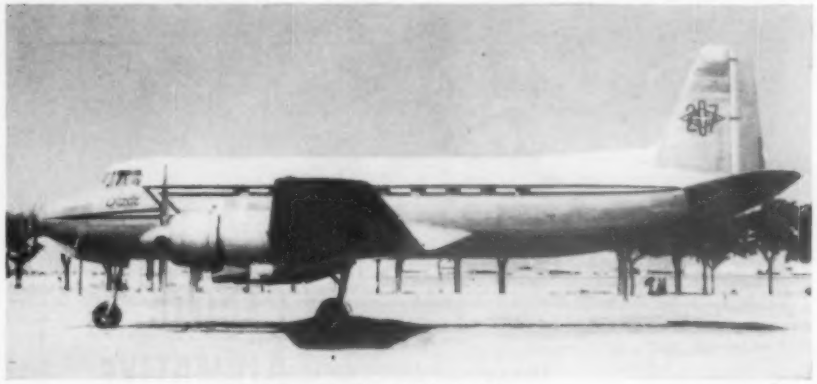
The result is a service mail rate for the Pacific carriers.

Since rates are equalized over competitive segments, rates on non-competitive segments have been adjusted to provide an average yield for each carrier which reasonably approximates the overall recognized cost of mail service.

Proposed Mail Rates

	Cents per mail ton-mile
JAN. 1, 1954-Dec. 31, 1954	
Northwest (all Pacific services)	51.77
Pan American (all Pacific services)	51.77
JAN. 1, 1955-MAR. 31, 1955	
Northwest (all Pacific services)	46.76
Pan American (all Pacific services	46.76
ON AND AFTER APR. 1, 1955	
Northwest	
Seattle-Anchorage	47.00
Seattle-Honolulu	32.65
Seattle-Tokyo	46.44*
All other Pacific services	46.44
Pan American	
Seattle-Honolulu	32.65
San Francisco-Honolulu	32.94
Los Angeles-Honolulu	32.77
San Francisco-Tokyo	46.44*
Seattle-Tokyo	46.44*
All other Pacific services	66.05

* To be applied to the standard short-line distance of 5,078 miles.



Spain's 207 Azor

The third twin-engine aircraft model designed in Spain to reach the production stage, the all-metal 207 Azor is fitted with two 2,040 hp. Bristol Hercules engines and can carry a maximum of 38 passengers over 1,085-mile routes.

CABIN
AIR VALVES
PASSENGER CONTROLLED

Douglas DC-6 and DC-7
Lockheed 749 and Aero Commander
Martin 404
Combination Air Valve and Reading Light Panel as Installed in Lockheed Super Constellation 1049

WEMAC AIR VALVES provide a wide range of angular adjustments to control airstream direction and rate of flow by rotation of nozzle. Air leakage and weight are held to a minimum (tested 100% to aircraft specifications). Made of metal and/or plastic. Plastic can be colored to match or contrast with cabin decor.

We Also Manufacture

- EDGE-LIGHTING PANEL LIGHTS
- ADJ. CABIN LIGHTS, READING & COCKPIT FLOODLIGHTS
- ELECTRICALLY HEATED EQUIPMENT

For Complete Details Please Write

wemac
COMPANY
Designers and Manufacturers
502 SOUTH ISIS AVENUE
INGLEWOOD, CALIFORNIA

Representatives:
George E. Harris & Co., Inc.
1734 North Hillside
Wichita, Kansas

Edward Marek
George E. Harris & Co. Inc.
444 Dexter Horton Building
Seattle, Washington

CHECKPOINT *for excellence*

PAC "POWER BY THE HOUR"

AS LOW AS $2.86* PER ENGINE OPERATING HOUR...PAC reliability has improved average operating time for all contract customers · PAC absorbs your current inventory · No more inventory investment · No more inventory obsolescence · No more parts shortages.

NO MORE INVENTORY...Investigate PAC "Power by the Hour" now for Savings and Safety.

*R-2000 engines

AUTOMATIC PILOT...Choice of many Executive Aircraft Captains...Bendix Eclipse-Pioneer PB-10-Automatic pilot...proved safety, performance and dependability under all types of weather conditions...sold and installed by PAC Products Division, together with a long line of top name aircraft parts and accessories.

PAC ONE STOP SERVICE

Major Overhaul and Modification...custom interiors · instrument panels · radio installation · hydraulic and electrical systems · tank seal · painting, storage and gas service · One of the nation's most completely equipped facilities for maintenance, overhaul and modification of aircraft.

PAC AERO PNEUMATICS

Manufacturers of Cabin Pressurization and Low Pressure Pneumatic Equipment...cabin pressure regulators · safety valves · shut-off and modulating valves · flow controllers · pneumatic power pressure regulators · Aero Pneumatics Div., Burbank, Calif. or Russell Associates, Brightwaters, L.I., N.Y.

PAC TEST & GROUND HANDLING EQUIPMENT

Manufacturers of a Complete Line of Test and Ground Handling Equipment...portable hydraulic test stands · hydraulic test benches · magneto and propeller test stands · "tilt-arc" engine handling units · Fully staffed and equipped to design and manufacture specialized high capacity equipment to customer requirements.

Other Divisions:
CALIFORNIA
Chino
Oakland
WASHINGTON
Seattle
KANSAS
Kansas City
COLORADO
Denver
NEW JERSEY
Linden

PACIFIC AIRMOTIVE CORPORATION

2940 No. Hollywood Way, Burbank, Calif.

New Plan Devised by USAF Pilots Accelerates Atomic-War Training

By William Coughlin

Las Vegas, Nev.—New delivery methods worked out by the pilots themselves may allow the Air Force to speed up the training of pilots in tactical atomic warfare. Some of the details were revealed here during the Special Weapons phase of the 1955 U. S. Air Force Fighter Weapons Meet.

First details of the new method of atomic training was disclosed by Col. R. C. Franklin Jr., of the 21st Fighter Bomber Wing, United States Air Forces in Europe.

Col. Franklin was interviewed by AVIATION WEEK after his team, flying F-86F Sabre Jets in their initial appearance in the classified Special Weapons event, placed second—and in doing so defeated a number of more-experienced units.

The team commander said both the F-86 and new training methods developed within his unit were responsible for the remarkable performance of the team. He credited Marine Maj. George H. Dodenhoff with development of the atomic delivery techniques. Dodenhoff, familiar with both Navy and Marine operations, is now on exchange duty with the USAF unit.

"The heart of our training method is in insisting that each pilot fly a standard maneuver," Col. Franklin explained. "We make him do it by the book. The setting on all our planes are exactly the same. The problem is calculated once and fed into all airplanes, and the pilots are made to fly it that way."

"Kentucky Windage"

The "Kentucky windage" factor is thus removed and each pilot forced to stick to the standard technique.

While details of the Special Weapons competition were classified, it is known that there were three types of drops used:

- **High angle dive bombing.**
- **Low angle bombing system with an** initial point.
- **Low angle bombing system without** an initial point.

The low altitude system involves "toss" bombing with a 4-G "over-the-shoulder" getaway maneuver to reverse course and escape the atomic blast.

"Every delivery we make is strictly on instruments, an all-weather delivery," Col. Franklin said. "We use only an operational delivery, there are no soft tosses."

The team captain pointed to himself as a "walking example" of the effectiveness of the standardized training method. With only 15 days practice in special weapons delivery, Col. Franklin not only led his team to second-place in the meet but won individual trophies for first place in low angle bombing with initial point and for high team captain.

The first "shape" that any of the USAFE team had ever dropped was a competitive bomb in this meet, Maj. Dodenhoff said. Practice sessions were with smaller conventional bombs. "Our method is so standardized that we can compute the ballistics from the bombing tables and obtain acceptable delivery immediately," he said.

Delivery Pattern

With this standardized tactical delivery, it actually is not necessary for the pilot to even know what type of weapon is hung on his airplane, Dodenhoff said. "The problem is computed, he flys the same delivery pattern and the bomb releases at the right time."

"What we are trying to sell is our

AIRCRAFT ELECTRICAL SOCIETY

12th ANNUAL DISPLAY

OF

AIRCRAFT ELECTRICAL EQUIPMENT

PAN PACIFIC AUDITORIUM LOS ANGELES

Show Hours: **October 27: 6.00 p.m. thru 11.00 p.m.**
October 28: 12.00 noon thru 10.00 p.m.

The Aircraft Electrical Society Exhibition is the only one of its kind, and caters exclusively, on a National basis, to the users of airborne electrical equipment and to other electrical fields.

This year, the A.E.S. Display will open following the closure of the 1955 Technical Conference on Aircraft Electrical Applications sponsored by the A.I.E.E.—Los Angeles.

Over 10,000 Engineers will attend this Display.

This year, over 200 National Manufacturers will display their products ranging from miniaturized components to complete airborne generating systems, offering the opportunity to examine and compare the newest component designs and systems . . . to obtain the latest information on current equipment development.

Invitations free upon request to A.E.S., 920 So. Robertson Blvd., Los Angeles 35

ADMISSION FREE—INVITATION HOLDERS

Jet Engine Blades with Superior Fatigue Strength are Produced by the Eaton ROLL-FORM Process

EATON® ROLL-FORM

The Eaton ROLL-FORM Process, originated and developed by the Eaton Manufacturing Company, has produced millions of jet blades by a simple rolling operation. The grain structure of the metal is rolled to conform to the blade contour, thereby producing a blade with superior fatigue strength characteristics.

In addition, the ROLL-FORM Process produces blades with a minimum of forging and machining scrap. This means worthwhile economies in the costly alloys which represent an ever larger proportion of the raw materials being used in jet engine blade production.

EATON MANUFACTURING COMPANY
AIRCRAFT DIVISION
BATTLE CREEK, MICHIGAN

method of training," Col. Franklin said. "Any six pilots in the wing would have done as well, that is the important thing. Our training methods make the airplane and pilots interchangeable."

Franklin said no competition was held in his wing to select the pilots for the special weapons meet. "We just picked the pilots available from the group," he said. "Some of our best people still are in Europe due to our operational commitments. We did not dare strip our unit of all its best people."

Low Angle Bombing

The primary mission of the 21st Fighter-Bomber Wing is delivery of atomic weapons, and it is maintained combat-ready at all times.

Under the unit's training methods, all factors can be fed into the low angle bombing system (LABS) instrument prior to takeoff with one exception. The only item left to last-minute calculation is wind at the target.

The basic element in this system of delivery, Dodenhoff said, is the elimination of the "Kentucky windage" factor under which each pilot develops the delivery technique which he thinks best fitted to his individual foibles. The standardized method makes possible widespread training of many pilots in accurate tactical atomic delivery, Dodenhoff believes.

Noting that the standardized method can be based on bombing tables, the Marine officer pointed out that in the event of a major conflict in which new types of bombs came into use, acceptable accuracy in delivery could be maintained throughout. And Col. Franklin concluded:

"We hope influential persons will show interest in not just what scores were made here but how the scores were attained and methods used."

Scorpion Sampling

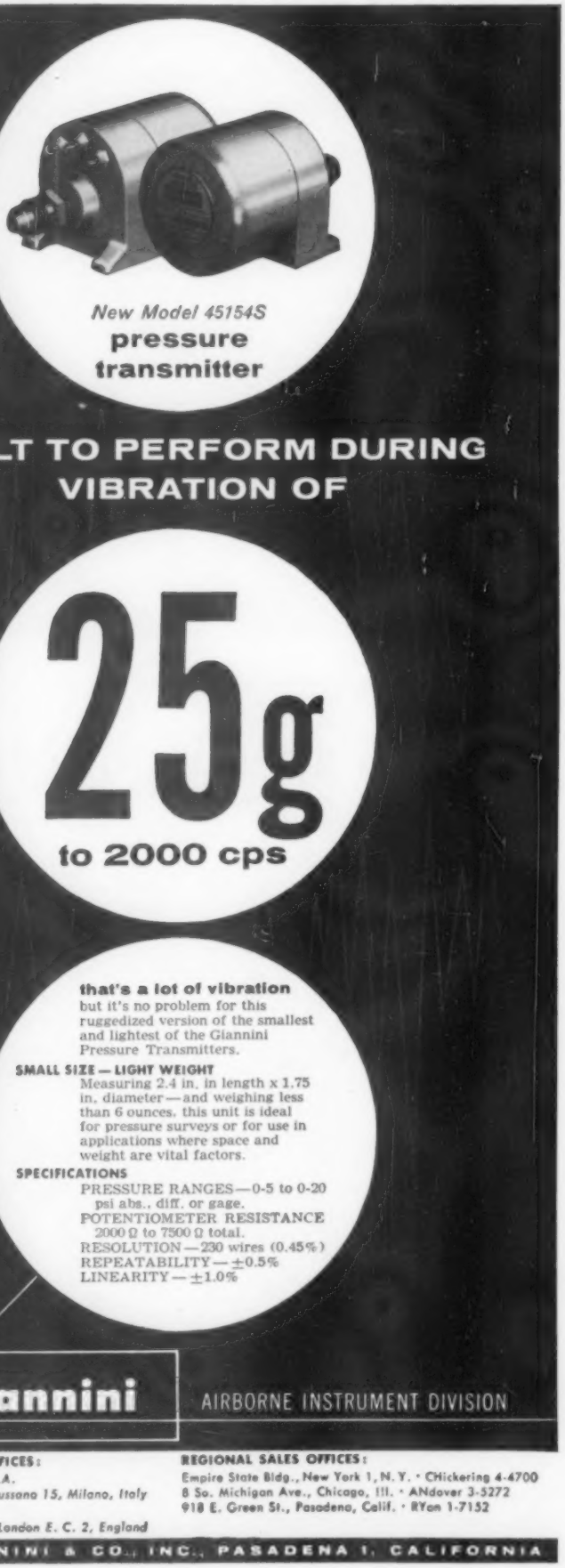
The Air Force has been accepting production Northrop Scorpions for more than a year on the same basis used in the acceptance of the Lockheed T-33 (AW Oct. 3, p. 23).

Only one out of every four Scorpions is flight-tested by USAF pilots. If it is approved, the other three are accepted without military flight test, saving the government time and money.

Provision is made to increase the sampling ratio to one-in-eight when statistics indicate it is warranted.

Piasecki Leases Plant

Piasecki Aircraft Corp. plans to develop an aircraft manufacturing area at Philadelphia International Airport. The firm expects to move into buildings leased from the city within a month.


New Model 45154S
pressure
transmitter
BUILT TO PERFORM DURING
VIBRATION OF
25g
to 2000 cps
that's a lot of vibration
but it's no problem for this ruggedized version of the smallest and lightest of the Giannini Pressure Transmitters.
SMALL SIZE — LIGHT WEIGHT
Measuring 2.4 in. in length x 1.75 in. diameter — and weighing less than 6 ounces, this unit is ideal for pressure surveys or for use in applications where space and weight are vital factors.
SPECIFICATIONS
PRESSURE RANGES — 0-5 to 0-20 psi abs., diff. or gage.
POTENTIOMETER RESISTANCE 2000 Ω to 7500 Ω total.
RESOLUTION — 230 wires (0.45%)
REPEATABILITY — ±0.5%
LINEARITY — ±1.0%
Giannini
AIRBORNE INSTRUMENT DIVISION
FOREIGN SALES OFFICES:
Giannini Italiana S.p.A.
Via Alberto Da Giussano 15, Milano, Italy
Giannini Limited
1 Copthall Close, London E. C. 2, England
REGIONAL SALES OFFICES:
Empire State Bldg., New York 1, N. Y. • CHickering 4-4700
8 So. Michigan Ave., Chicago, Ill. • ANdover 3-5272
918 E. Green St., Pasadena, Calif. • RYan 1-7152
G. M. GIANNINI & CO., INC., PASADENA 1, CALIFORNIA

Performance vs. Tradition:

Gnat Wages Uphill Battle for Acceptance

By David A. Anderton

Hamble, England—The Folland Gnat has become England's most controversial airplane. Praised by service and foreign pilots as the logical answer to the problems of fighter-interceptor design, the Gnat has been plagued by a long-time lack of official backing, by foot-dragging in procurement and by illogical arguments.

Its most ardent supporters are the many pilots who have flown it or the Midge, its aerodynamic prototype. Its loudest detractors are among the military brass, the civil servants and competing companies.

But in balance, the case for the Gnat seems to be winning out. Here's why:

• **Development batch of Gnats has been ordered** by the Ministry of Supply for evaluation; the number has not been stated but should compare to the 20 English Electric P.1 interceptors ordered in a similar program.

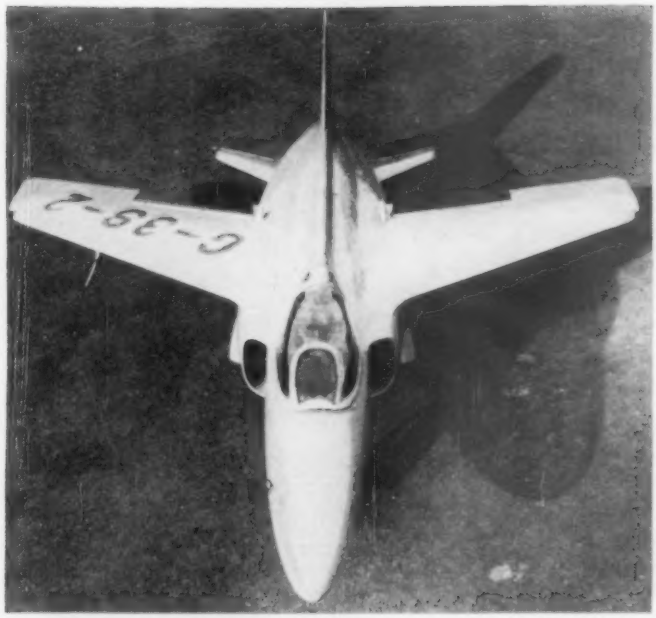
• **Negotiations with foreign countries**—particularly India—have followed interest by those countries in the Gnat. In recent weeks, Folland has been visited officially by missions from India, Finland, Holland, Belgium, New Zealand, Germany, Jugoslavia and Switzerland. The Canadian Navy is interested in a Sea Gnat carrier modification; the U. S. Navy has asked for bids on a special version of the airplane.

• **Squadron Leader Tennant's demonstration of the Gnat** thrilled Farnborough crowds this year as did his show of the Midge in 1954 (AW Sept. 20, 1954, p. 13). Tennant, chief pilot for Folland, made highspeed runs at 580 knots or better (close to Mach 0.9) low above the runway, finishing with a rocketing climb on his first run, and turns of 7G on his subsequent passes.

The sparkling display impressed aviation journalists—one London newspaper carried an article praising the Gnat and headed it: "Who will rescue this airplane?"

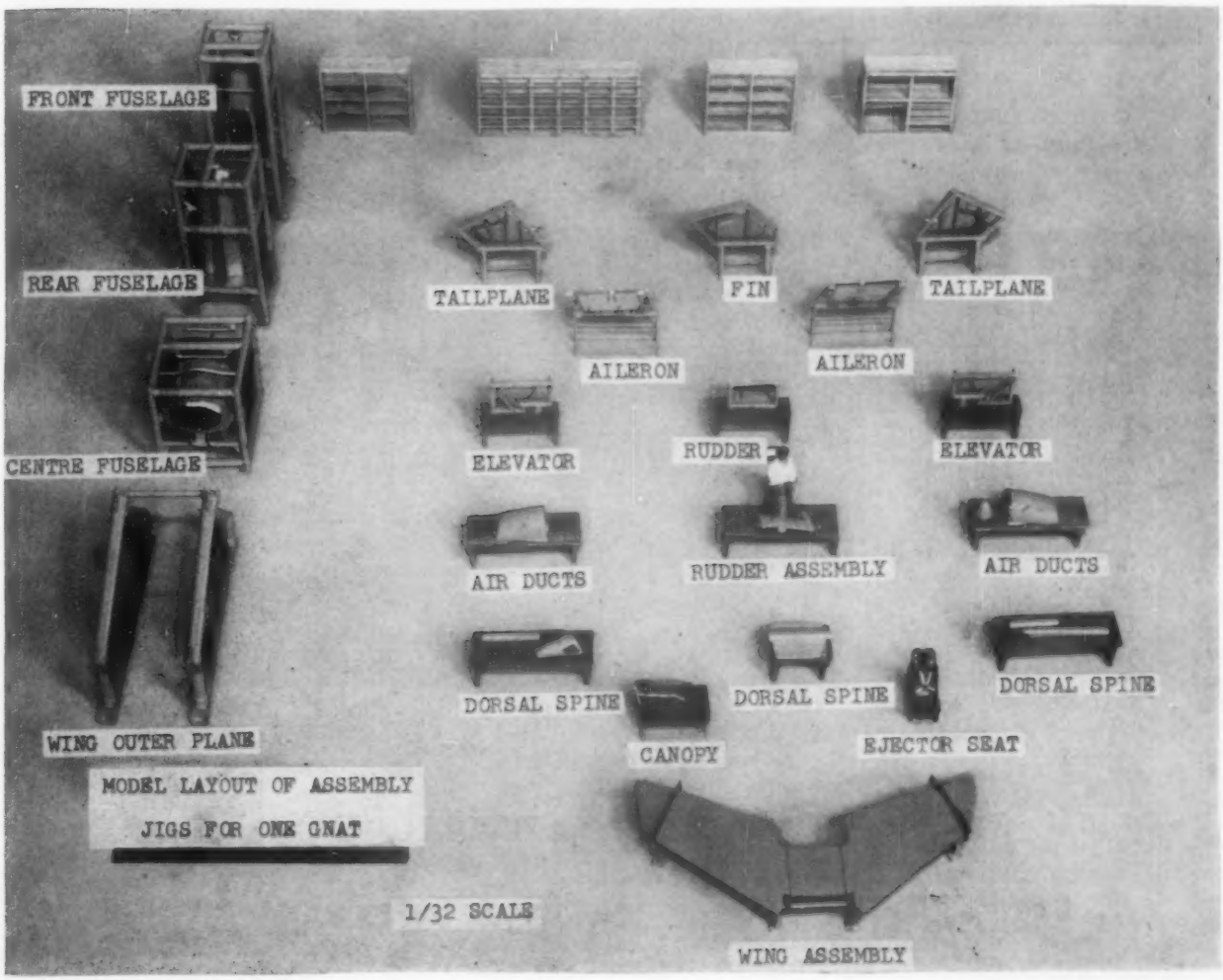
• **Reaction of pilots at the Aeroplane and Armament Experimental Establishment** (official proving ground of RAF

GNAT PERFORMANCE at Farnborough helped plane overcome official foot-dragging.



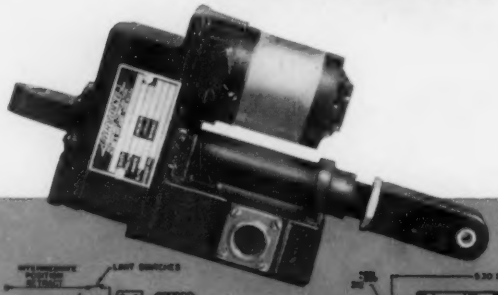
POWERED BY ORPHEUS jet engine, Gnat has been heralded by Folland as "the world's first successful light jet fighter." Plane is easily controllable right up to high-subsonic performance limit.

POWER-OPERATED inboard ailerons droop when undercarriage legs are fully down and serve as flaps to steepen angle and reduce Gnat's landing-approach speed.



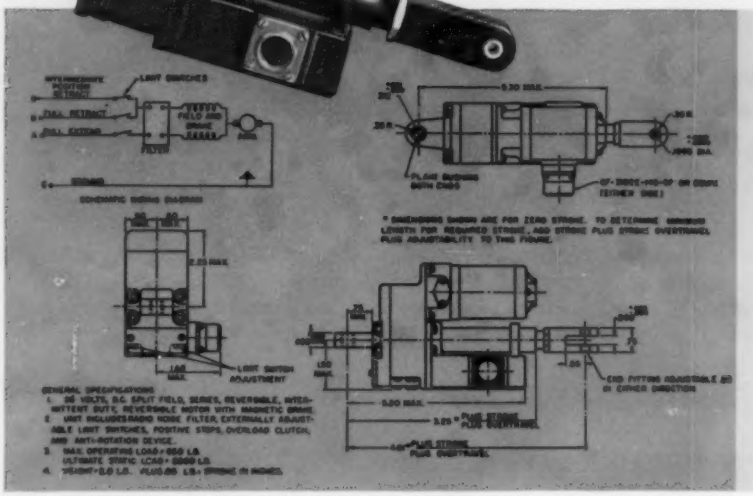
THE INFORMATION ON THIS PAGE IS TYPICAL OF THE DATA YOU WILL FIND IN THE NEW AIRBORNE CATALOG

LINEAR ACTUATORS

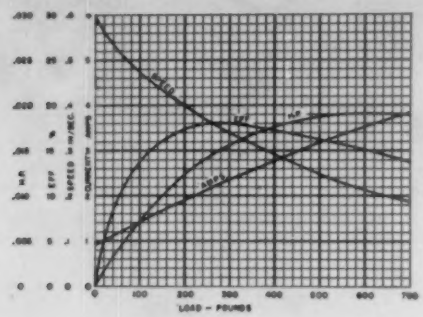


R-580

650 lb. max. op. load
with intermediate
position switch
wt. 2.0 lbs.

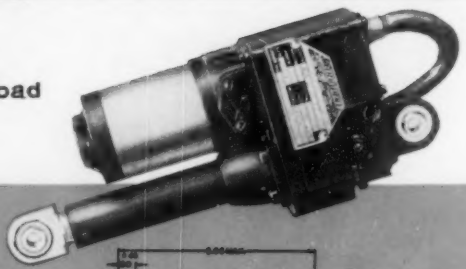


AVAILABLE FOR EITHER 26 V D.C.
OR 400 CYCLES A.C.

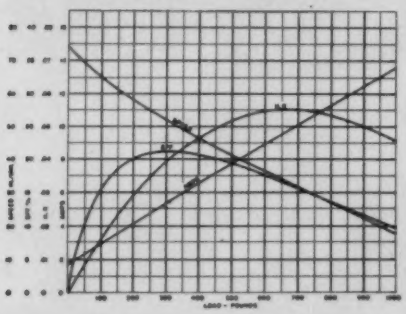


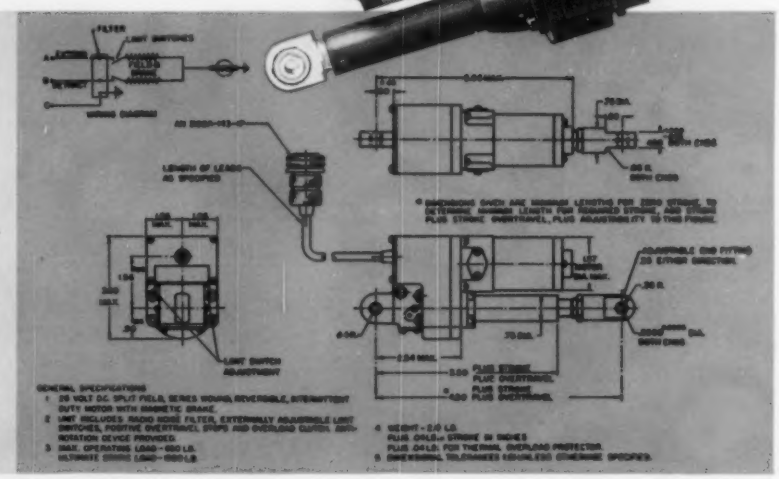
R-584

650 lb. max. op. load
wt. 2.0 lbs.



AVAILABLE FOR EITHER 26 V D.C.
OR 400 CYCLES A.C.





LINEATOR® • ROTORAC® • TRIM TROL® • ROTORETTE® • ANGLGEAR • ROTOLOK

AIRBORNE
ACCESSORIES CORPORATION
HILLSIDE 5, NEW JERSEY

Represented in Canada by: WINNETT BOYD LIMITED • 745 Mt. Pleasant Rd., Toronto 12, Ont.

NEW AIRBORNE CATALOG
Contains full information on the Airborne line of electromechanical actuators and feel systems. Write for your copy today.

equipment) was enthusiastic. A&AEE pilots, who have almost unanimously roasted every postwar British military airplane, reported complete satisfaction with the Midge. In particular, they singled out the longitudinal control system for praise, emphasizing by indirection the known inadequacies of that control on other British aircraft.

Tangible Proof

The Gnat is tangible proof of the light-fighter concept; its design philosophy—to do unto others more, for less, than they can do to you—is the product of W. E. W. Petter.

Like the Gnat, Petter is a controversial figure.

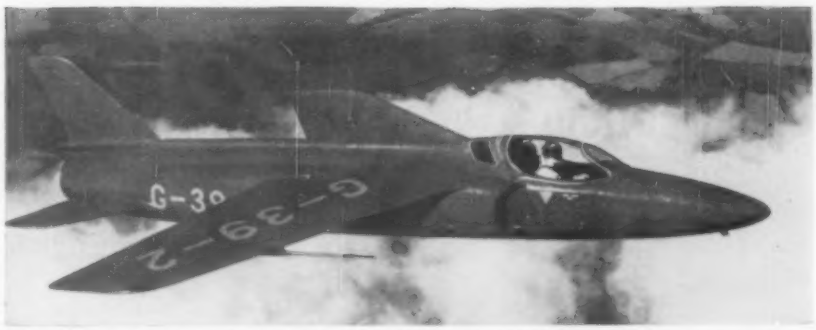
To his design credit are the Westland Lysander, Whirlwind and Welkin and the English Electric Canberra; he also contributed to the concept of the P.1 before he left English Electric. He refuses to be bound by tradition in design and has locked horns publicly with one or more of the old-time British designers. This has not made the path any smoother for the Gnat.

But Petter's stubborn refusal to give an inch, plus his determined drive to get the light-fighter concept accepted, have pushed the tiny blue plane into being and into the limelight of argument.

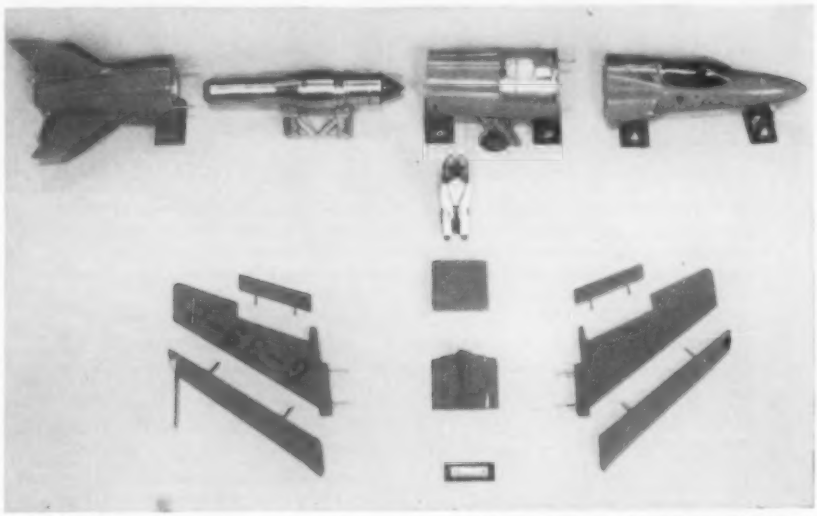
Basically the Gnat has performance matching or bettering its contemporaries. Its speed is high subsonic, and it remains easily controllable right up to its performance limits. "You fly the Gnat," said one British test pilot, "It doesn't fly you."

It can stay in the air for more than one hour with internal fuel and for two hours with external tanks. Its ceiling is over 50,000 ft., and can be expected to improve as the airplane and engine develop during the next few years.

Span of the tiny craft is 22 ft. 2 in.; overall length is 29 ft. 9 in. Wing sweep is 40 degrees. Gross weight is under 7,000 lb.



SIDE VIEW shows Gnat's low horizontal all-flying tail, high swept wing.



MODEL designed by Folland shows Gnat sub assemblies. Parts are 1/24th actual size.

Powerplant of the Gnat is the Bristol Orpheus axial-flow turbojet, an engine with a thrust-weight ratio approaching five. Now rated near the 4,000-lb. thrust level, the Orpheus is expected to be type-tested at 4,850 lb. by the end of this year.

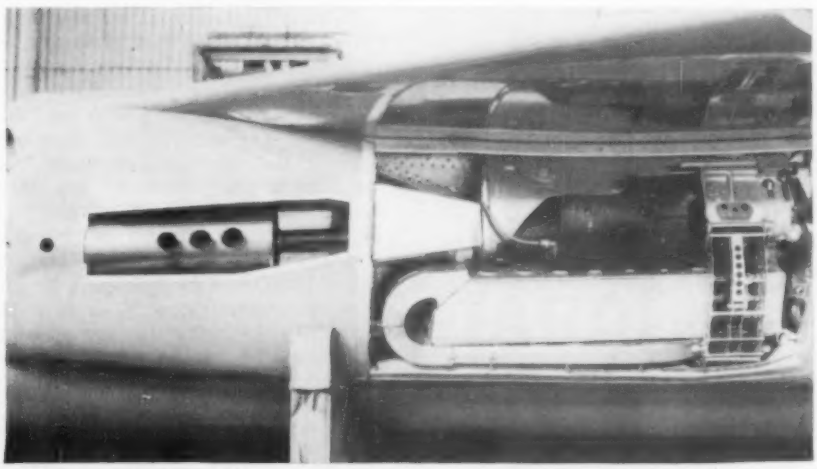
Meanwhile, production of the first few Gnats is on schedule. The third airplane—second Gnat—is in the jigs nearing completion. Production jigs and fixtures are being built on a small section of the crowded main assembly floor of the Folland plant here. Subassemblies for Number Four and later airplanes should now be headed for component assembly.

Design Improvements

Paralleling production development is a program to keep the Gnat design abreast of the changing aeronautical times. Aerodynamic and structural improvements are slated for incorporation in early models. Among the contemplated developments for the Gnat:

• **Slab tail for aerodynamic efficiency above sonic speed.** Current Gnat elevator design—a modified all-flying tail—holds its effectiveness up to Mach 1 in flight. One example: Tennant has pulled more than 6.5G at 25,000 ft. at an indicated Mach number of 0.95, with the stick force less than 30 lb. Petter said that engineering has been completed for the slab tail design but that he intends to hold off on the Mk.1 Gnats because of the increased cost and maintenance associated with slab tail.

• **Thin wing of 6% thickness-chord ratio** replacing the present 8% surface. This thin wing has been designed and



DETAILS of the Gnat's 30 mm. gun installation are revealed in static display.

From Wyandotte . . . answers to modification & maintenance problems

At Wyandotte's modern research center (above), performance-proven products are developed and tested. Practically any cleaning problem can be duplicated and studied. In addition to huge plants in Wyandotte, Mich.— Wyandotte's vast facilities for producing specialized cleaning products include a new plant in Los Nietos, California.

	YOUR PROBLEM	ANSWER	DESCRIPTION
1	Steam cleaning	Altrex*	Cuts scale formation; removes all types of soil from aircraft exteriors, decks, engines.
2	Emulsion cleaning	1-2364	Meets USAF Specification 20015-E and MIL-C7122 (Aer). Will not craze plastics.
3	Carbon removing	P-1075	Nonflammable, noncorrosive cold-tank carbon remover for jet- and piston-engine parts.
4	Integral fuel-tank desealing	2789	A "universal" desealant for removing all types of sealing compounds. Nonflammable.
5	Removing exhaust stains	#20	Removes stubborn exhaust stains; prevents corrosion in exhaust-stained areas.
6	Paint removing	Sprazee	Aircraft paint remover. Meets Specification AF-14119-C.
7	Engine test-cell cleaning	El-Bee*	An all-soluble cleaner for removing dirt, oil, and grease from concrete surfaces.
8	Washing-machine cleaning	397	A special low-foaming, non-etching aluminum cleaner. Meets Specification MIL-C-5543.
9	Aluminum brightening	Alutone*	Brightener for exterior aircraft surfaces. Cleans and brightens in a single operation.
10	Floor absorbent (anti-slip)	Zorball	An all-purpose floor absorbent; makes floors skidproof, safe at lowest use-cost.

*REG. U.S. PAT. OFF.

MAIL COUPON TODAY FOR FULL DATA

Wyandotte CHEMICALS

AIRCRAFT DEPARTMENT 2321 • Wyandotte, Michigan

Please send FREE DATA on each problem whose number I have circled.

1 2 3 4 5 6 7 8 9 10

Name_____ Title_____

Firm_____

Street_____ Zone_____

City_____ State_____

built in Folland's experimental shop. Structural testing of the surface has been successful and it will be incorporated on production Gnats at an early date.

• **Redesign of the upper back of the fuselage.** The dorsal spine of the Gnat is enlarging because there are more things to put in it, and the rear fuselage may be expanded to accommodate an afterburner for the Bristol Orpheus. Both these changes may force a reshaping of the rear contours of the fuselage to eliminate the indentations on the upper surface, either side of the spine.

• **Cockpit modifications in layout.** The throttle quadrant will be lowered a little for better visibility of the side shelf; all side instruments are to be angled to match the pilot's line of sight.

• **Other aerodynamic changes of a minor nature**—such as trying out wing fences because of the slight tendency of the Gnat to drop off on a wing at the stall. The duct inlet lip is being cut back now to find its effect on engine performance and inlet-engine matching.

Petter says the area distribution of the Gnat is probably favorable enough so that the plane would not have to be redesigned to the area rule.

Gnat Aerodynamics

Aerodynamic design of the Gnat is conventional by current standards. The wing is of low aspect ratio (3.6) and is swept 40 degrees.

The horizontal tail is set low on the fuselage to avoid pitch-up problems; its sweep is greater than that of the tail.

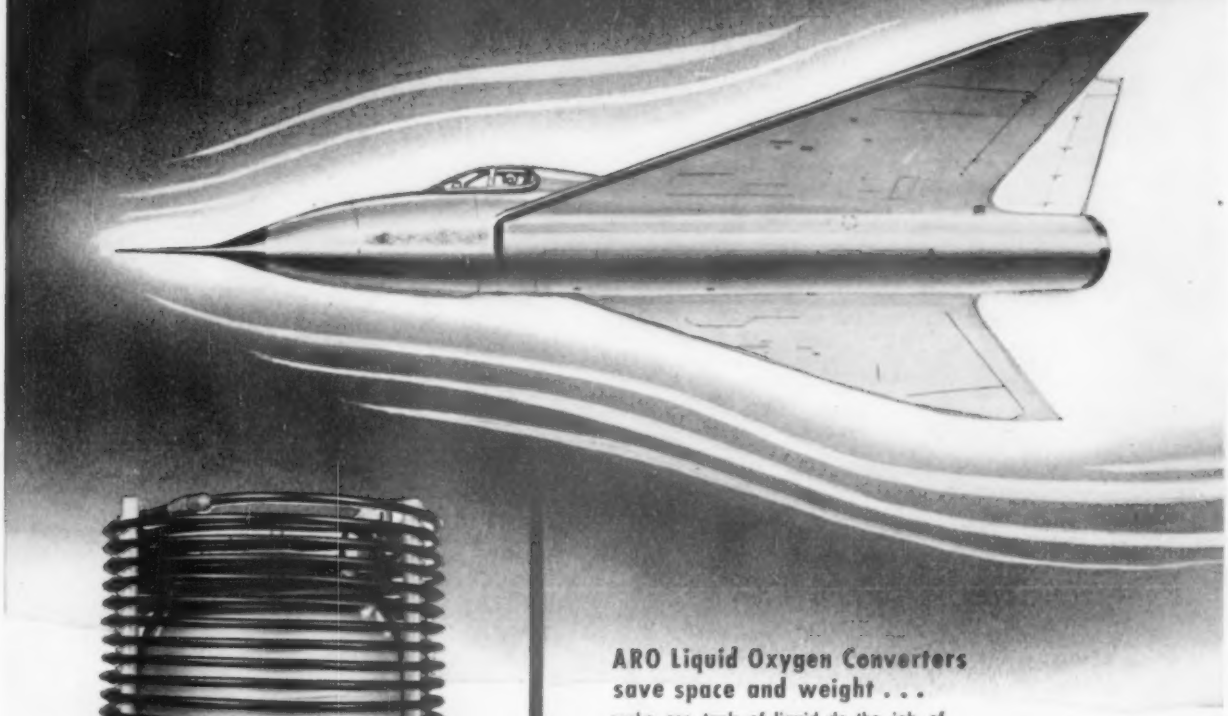
Both wing and tail are of constant 8% thickness-chord ratio, but, as mentioned above, the wing will be changed to a 6% value in later production airplanes.

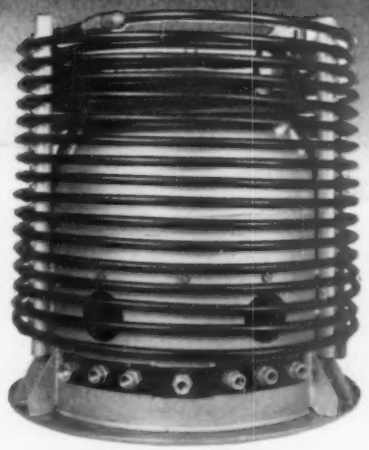
Two features help account for the maneuverability of the Gnat—inboard ailerons and a variation on the all-flying tail.

The inboard ailerons are power-operated; they droop to act as flaps during the landing approach. The design was tried on the second wing fitted to the Midge and proved completely satisfactory. The rate of roll stayed the same, the landing approach with ailerons drooped was slower and steeper and the landing run was reduced.

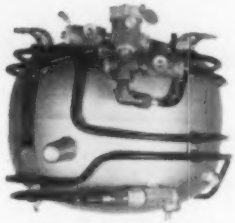
The Gnat horizontal tail combines power and manual operation. The stabilizer is powered by hydraulics for large deflections, and there is an overriding electric trim motor for the stabilizer. Elevators are manually operated from the stick. Motion of the elevator moves a valve which allows the hydraulic system to operate the stabilizer as a follow-up. The pilot may switch the hydraulic power system in or out as he

ARO *Vision-eering Leads*
IN OXYGEN EQUIPMENT





2u LITER CONVERTER



5 LITER CONVERTER

ARO Liquid Oxygen Converters save space and weight . . .

make one tank of liquid do the job of many tanks of gaseous oxygen! This important forward step in oxygen supply is another ARO *first!*

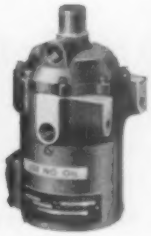
In the specialized sphere of oxygen equipment and components for high altitude flight . . . aviation looks to ARO for leadership!

ARO research and development have pioneered and perfected many of the new products to control the vital oxygen supply for the men who fly "way upstairs." Leading aircraft makers depend on Aro for a growing number of precision products. For further details write:

THE ARO EQUIPMENT CORPORATION
BRYAN AND CLEVELAND, OHIO
Aro Equipment of California, Los Angeles, Calif.
Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ELECTRICAL TRANSDUCER GAGING SYSTEM

An IMPROVED means for measuring contents of Liquid Oxygen Converters . . . provides a continuous sight-reading of amount of liquid oxygen remaining in a converter.



ARO

AIRCRAFT PRODUCTS

Liquid Oxygen Converters, Oxygen Regulators, Pressure Regulators, Contents Gauges, Relief Valves, "Anti-G" Valves, Air and Oxygen System Accessories, Actuating Cylinders and other Aircraft Accessories.

desires. Tail deflection is from zero to

SAW-WHET OWL LANDING

One of the few things that fly . . .
that couldn't be made better
with 3M Adhesives, Coatings and Sealers

For a free booklet illustrating 3M Adhesives, Coatings and Sealers at work in the aircraft industry today, write to 3M, Department 2410, 417 Piquette Avenue, Detroit 2, Michigan. For even faster facts, call in your 3M Field Engineer.

ADHESIVES AND COATINGS DIVISION **MINNESOTA MINING AND MANUFACTURING COMPANY**

desires. Tail deflection is from zero to minus 12 deg. incidence.

The rudder is not powered but has centering springs.

The first reaction of any observer of the Midge and Gnat in flight is apt to be, "You can't maneuver like that!" To see Tennant pulling tight turns at near-zero altitudes is an unforgettable and startling experience. Seen from behind, the Gnat appears to quarter-roll up on a wingtip and then pull into a turn of tiny radius.

Handling the Gnat

Takeoff of the Gnat at Farnborough was somewhat longer than expected; part of this was due to the de-rated thrust of the Orpheus, and part to the natural caution of a pilot with the only prototype at a public display.

Rate of roll of the Gnat is extremely high, comparable to a delta's rate. If the power boost is not used, the ailerons stiffen up at high Mach numbers, as is expected. Both Tenant and L. M. Whittington, who is the other Folland pilot, believe they could fight with the Gnat without power on the controls. But they are both powerfully built, and the job of flying without power might not be so easy for a smaller or lighter man.

The Gnat shows no tendency to pitch up or to dig in during accelerated maneuvers, say the pilots, nor is there any evidence of buffeting at high Mach numbers.

Stall is gentle and occurs at about 104 knots true IAS with the airplane dirty and at about 109 knots true IAS in the clean condition. Approach speeds are around 115 to 120 knots. The Gnat shows some tendency to drop out of the stall on the left wing, but at that time the attitude is so nose-high that Tenant feels there is no danger of stalling out on approach. Approach speeds are between 115 and 120 knots.

There is no speed restriction on lowering the brakes, which are formed by the landing gear doors and the gear itself, lowered only partially. With the brakes down, the Gnat decelerates from top sea level speed to landing speed in about one minute.

At first glance, there might appear to be pilot objection to the track width of the landing gear, which is only 61 inches. Tennant said that other pilots had mentioned it before flight but not after making landings, indicating that there was no trouble.

Gnat Structure

Simplicity was Petter's guiding star in developing the Gnat. Its structure is a model of simplicity.

Basis of the airplane is a single large forging that serves as the attachment point for wing, landing gear and guns. Forward of this is a box made of vertical

The newest EDISON fire detection system now provides positive protection for another of America's great aircraft—CONVAIR's B-36 long-range intercontinental bomber.

Prompt fire detection is assured even if the sensing cable breaks, for each half will function as a closed circuit. And the entire EDISON system operates directly from the aircraft power supply without the need of electronic tubes.

Years of actual experience and constant research in the world-famous EDISON Laboratory provide this aircraft fire detection system to keep pace with the advancements of modern flight.

Other outstanding features:

▶ **exclusive snap clamps** simplify installation and speed maintenance—no tools needed

▶ **maximum sensitivity** for each zone because a single detector circuit can provide varying temperature alarm settings

▶ **low impedance design** completely eliminates false alarms due to moisture or capacitive effects

▶ **minimum weight construction**—d.c. control assembly weighs only .8 lbs., 100 ft. of sensing cable only 1 lb.

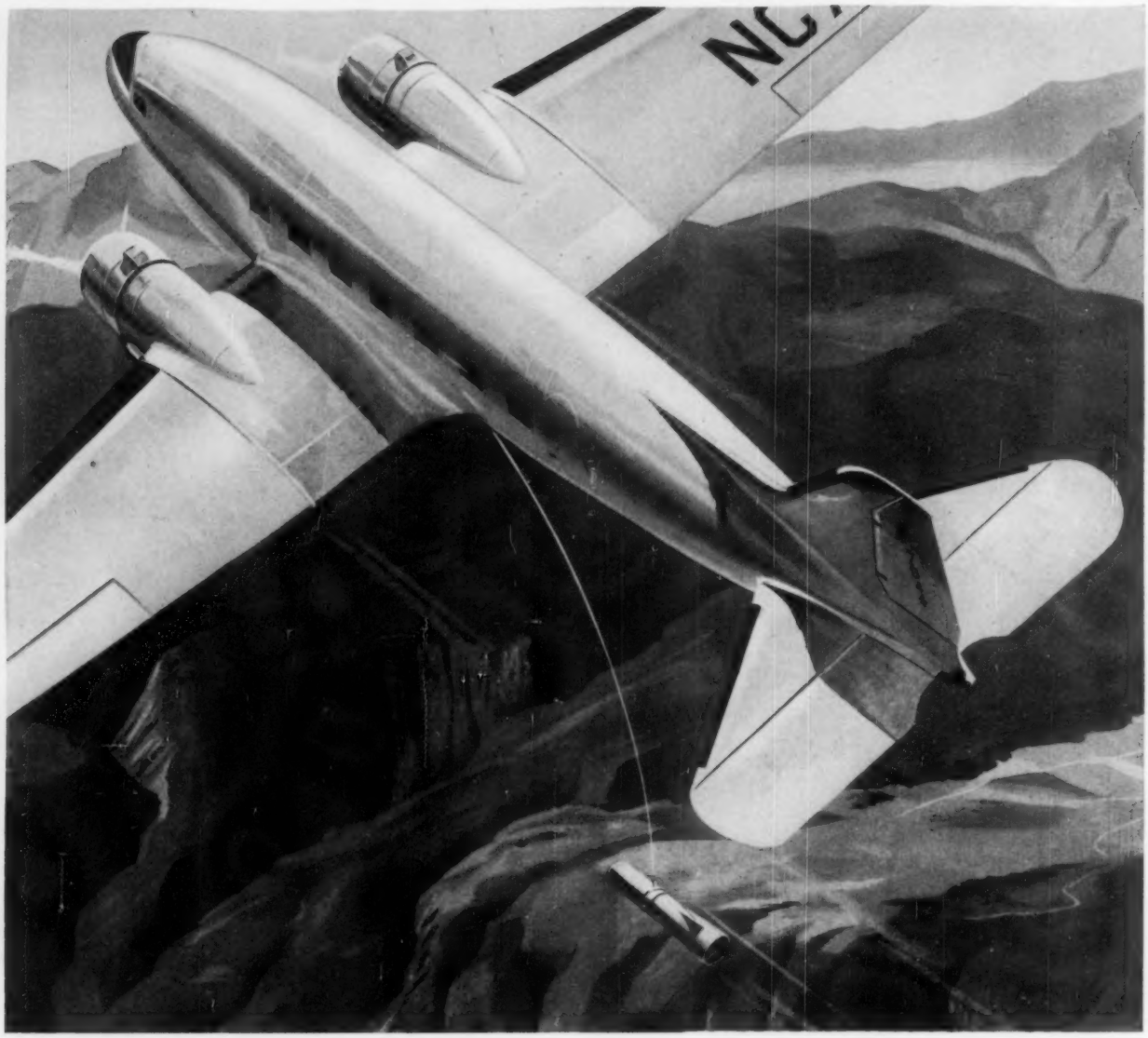
Write us today for particulars on this great new EDISON development!

Thomas A. Edison

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

Thomas A. Edison
INCORPORATED

INSTRUMENT DIVISION • 49 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY



TARGET...OIL

The target of the torpedo-like device hanging from this plane is not the land you see ahead, but the oil that may hide beneath it.

Spearheading the mission, this sensitive instrument, known to petroleum men as a magnetometer, records the earth's magnetic field, indicating which land is most favorable for the presence of oil.

It is a lucid illustration of the interdependence of the petroleum and aviation industries. For as petroleum supplies the power of aviation, so aviation supplies the means to search for this power.

Cities Service has long utilized aviation for this important work. Likewise numerous airlines and airports have long utilized Cities Service products for their work. And just as these airlines and airports strive to provide the finest planes and service, Cities Service continues to provide the finest petroleum products to service these planes.

That's why you can always be sure of the highest quality aviation oils and gasolene wherever the familiar Cities Service aviation emblem is displayed. Look for it.

CITIES SERVICE AVIATION PRODUCTS

New York · Chicago · In the South: Arkansas Fuel Oil Corp.

shear webs and horizontal beams, running to the inclined bulkhead just behind the pilot. From there forward, the structure is conventional ring and stringer and is the pressurized portion of the plane.

To this basic box with a nose are buttoned the duct inlets and ducting, the dorsal spine and the ventral sections. Thus, the box is the only fuselage item that must be built in an expensive jig; the ducting and upper and lower sections can be bench-built in simple fixtures.

Six tapered locating pins define the wing position, and four bolts are the connection between wing and fuselage.

One of the most unusual test rigs in the aircraft business has been developed at Folland for measuring stresses in the airplane when the 30-mm. Aden revolver cannon are fired. It consists of a strong-back frame, much like any structural test rig, in which a forward fuselage partial section of the Gnat is spring-suspended. Springing has a low frequency and simulates the general dynamics of the airplane in flight.

More than 600 strain gages have been fixed to the fuselage section to measure the stresses; 100 of these are earmarked for the local loads produced by the firing. The reason for the rig is that the Aden has an offset breech mechanism, and firing the guns produces a torsional load from the recoil on the gun mount.

Powerplant

Folland engineers give much credit for the success of the Gnat to its powerplant, the Bristol Orpheus. This lightweight turbojet had never been flown before its installation in the Gnat prototype, and there was—quite naturally—considerable apprehension about its airborne performance.

Many hours of ground runs had proven the engine; the big question was what it would do in the air.

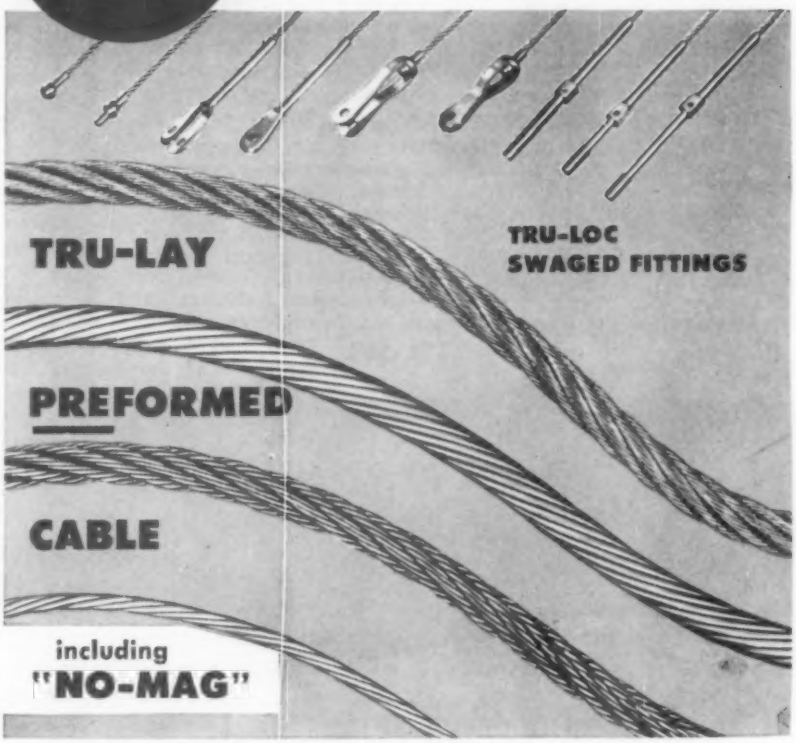
Before the first flight, Tennant had taxied the Gnat all over Chilbolton airfield at all speeds and attitudes to satisfy himself that the intakes worked and didn't stall out at angles of yaw or attack. Final proof came on the first flight, and the Orpheus has given no trouble during the test program.

The long-life Viper, used to power the Midge prototype, also proved its worth during the more than 110 hours racked up by that plane before it was lost during takeoff by Swiss pilot Max Mathez. Originally cleared for only 25 hr. flight time, the Armstrong Siddeley engine was cleared further for 50 hr. before the 25-hr. period had elapsed. The engine was changed at the 50-hr. mark and replaced with a new engine. The older engine was reworked and installed in the Midge at the 100-hr. flight time level.

One thing must be understood about

ACCO products

TRU-LAY Cables
TRU-LOC Fittings



Solving Aircraft Design Problems...

is an old story to ACCO. The originators of preformed cable and swaged terminals for aircraft use, ACCO engineers have now introduced new non-magnetic aircraft cables. The complete line of ACCO cables and fittings now includes . . .

New "No-Mag" Cable — ends instrument interference

New "NO-MAG" Aircraft Cables are made from Type 305 stainless steel. Their advantages include:

- Remain non-magnetic even after severe cold working—eliminate instrument interference through cable magnetism.
- Better corrosion-resistance properties than standard stainless steel cables.
- Thermal expansion characteristics are much closer than standard cable to characteristics of aluminum alloys used in aircraft—this simplifies maintaining cable tension under changing temperatures.
- High fatigue and abrasion resistance.
- Preformed construction.

TRU-LAY Cable Provided in all standard stainless and carbon steels in a complete range of sizes and constructions. Because it is preformed it

- Can be cut without seizing.
- Is easier to handle—less tendency to loop or kink.
- Can be installed in less time.
- Is free of tendency to rotate—runs true over sheaves or pulleys—is easier on pulleys.
- Has greatest resistance to bending fatigue—gives longer service.

TRU-LOC Swaged Fittings

- Guaranteed to hold to the rated breaking strength of the cable with which used.
- Eliminate costly, uncertain splicing.
- "*Quickies*"—specially developed double-shank ball-type terminals—make it possible to connect and disconnect control sections in an instant without tools.

Write Detroit office for specifications

ACCO

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

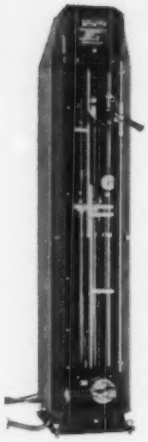
601 Stephenson Building, Detroit 2
2216 S. Garfield Ave., Los Angeles 22 • Bridgeport 2, Conn.

Aircraft Cable • Swaged Fittings

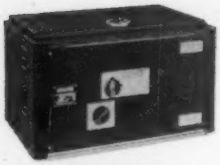
pre-cise (prē-sīs'), adj.; exactly or sharply defined or stated, not vague, minutely exact, reliable, not varying in the slightest degree from accuracy, standard, etc.

A fitting description of Ideal-Aerosmith test equipment. High engineering standards and rigid quality control production methods assure the reliability and minute exactness required by the industry today.

IDEAL PRECISION BAROMETER-CONTROLLERS PROVIDE AN ACCURATE METHOD OF CALIBRATION. Furnishing a range from 0″ to 100″ Hg, Ideal barometer-controllers can be used for precision calibration of such equipment as absolute or differential pressure sensing potentiometers; air data computer transducers; force balance system components; altitude controllers and switches; altitude transmitters; standard pressure activated aircraft instruments, such as sensitive alimeters; and in special applications, sensitive or true airspeed indicators and transmitters, machmeter indicators, machnumber transmitters.



Barometer-Controller
Model 10-64-30



Servo-Valve Unit for
Barometer-Controller

Micro Reader Unit for
Barometer-Controller

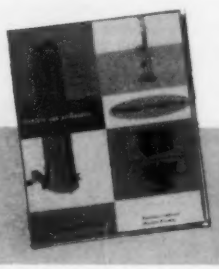
for precision pressure control

IDEAL PRECISION TEST CHAMBERS FOR A WIDE RANGE OF APPLICATIONS. Ideal instrument test chambers are equally suited for use in the development laboratory, production calibration or final test of the multitude of pressure operated instrument mechanisms used in the latest aircraft and missile airframes. It is not unusual to see Ideal instrument test chambers being used in the receiving inspection departments of electronic system feeder plants to check many pressure operated potentiometers and related components more rapidly and dependably than ever before possible.

Test Chamber
Model 16-13-8

IDEAL PRECISION RATE-OF-MOTION EQUIPMENT BRINGS A NEW ACHIEVEMENT IN ACCURACY. In the development and manufacture of rate-of-motion equipment for aircraft and other types of industry, Ideal takes pride in its unusual facilities which permit the production of an extensive line of equipment from rate tables to tachometer testers. In addition to production of the many standard designs, Ideal is also prepared to meet the many unusual demands for special rate-of-motion equipment. Here again, Ideal equipment assures the utmost in accuracy and reliability.

Roll-Pitch-Yaw Table
Model 14-11-31



Our new pressure instrument brochure is now available... write or wire for your copy today.

IDEAL-AEROSMITH, INC. 12900 South Cerise Avenue, Hawthorne, California

the Gnat: It is a complete airplane, just as is the Douglas A4D, pioneering the light-fighter concept in this country. Instrumentation is standard, as are the equipment and controls. Cockpit layout is roomy enough to take Tennant in an inflated pressure suit, and that should provide room enough for most pilots.

Equipment includes a completely automatic and lightweight ejection seat, a gyro gunsight, oxygen regulator, VHF radio and standby set, DME, radar ranging or IFF gear, a braking chute and provision for a homing device. Cockpit temperature is regulated by the pilot; a single selector valve gives him cold, warm or hot air or intermediate mixtures.

The Gnat is tiny, and most of the maintenance work in the nose of the airplane can be done at waist height. When you stand alongside the airplane to talk with the pilot seated in the cockpit, his eyes and yours are about at the same level.

But for its size, it can pack a formidable wallop. It has twin 30-mm. cannon and can carry—for a short-range ground support mission—as much as 2,000 lb. of external stores, or roughly one-third of its normal gross. It can be adapted for carrier use an dwould require no wing folding. More than 25% extra complement of Gnats could be carried.

Thus the Gnat shows promise and proven performance. Its production design has been carefully planned for minimum cost and maximum ease of manufacture. Pilots fall in love with its performance, and technicians praise its concept and detailed engineering.

Five Gnats can be bought for the price of two Hunters, if some of the current figures of fighter cost are correct. In production, a Gnat would sell for between $150,000 and $175,000 ready to go.

Folland, with the highest airframe weight output per man in the British aircraft industry, has established itself as a firm able to guarantee deliveries on a wide variety of subcontracted items. The space is available to build the Gnats.

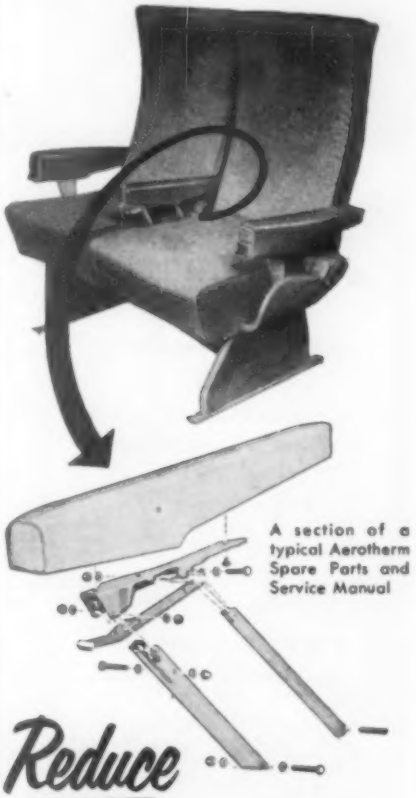
All Folland needs is the word to go ahead.

Tow Reel Handles Giant Banner Target

High-velocity tow reel, capable of pulling a giant banner target on a two-mile cable at speeds of more than 600 ph., has been developed for USAF by Northrop Aircraft, Inc. The reel accommodates 10,000 ft. of cable and can pull a target totaling more than 400 sq. ft. in area, nine ft. high and 45 ft. long. First reels off the production line will be installed in Martin B-57 and North American B-45 Tornado jet bombers with specially-redesigned bomb-bays. Several reels can be placed in each target-carrying airplane to provide a multiple-target capability.

AEROTHERM

AIRCRAFT SEATS



A section of a typical Aerotherm Spare Parts and Service Manual

Reduce

Maintenance with Interchangeable Parts

Uniformity of parts simplifies inventory and cuts maintenance costs.

Production tooling, stocked for future needs, assures interchangeability of replaceable parts for any Aerotherm seat.

Inventory reduction equals reduction of investment. Why not contact our Project Engineers on your seating problem?

Project Engineers:
THE THERMIX CORPORATION
GREENWICH, CONN.
THERMIX CALIFORNIA, INC., 5333 Sepulveda Blvd., Culver City, Calif.
Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec

MANUFACTURERS:
THE AEROTHERM CORPORATION
BANTAM, CONN.

NEW

radically new
all metal
vibration mount

withstands repeated
15-G
shock loading
(meets all requirements
of MIL-C-172-B)

yet weighs less than
conventional mounts

Resonant frequency less than 10 cps... magnification factor less than 1½ at resonance with no double peaks. "QPL", of course.

FINN

Pioneers in lightweight shock and vibration controls

T. R. FINN & CO., Inc.
200 Central Avenue
Hawthorne, New Jersey

Send for complete catalog

Rolls-Royce's Pearson Reviews Jet Engine Development Problems

Designers of British civil aircraft who want to use turbojet engines in the next five years should have plenty to choose from. But they may have to tailor the planes to the available powerplants.

If they choose turboprops, they will more likely find engines designed for their particular type and size of aircraft.

The reason, says J. D. Pearson, managing director of Rolls-Royce's Aero Engine Div., is that the impetus for turboprops in Britain has been mainly civil, with the military more interested in turbojets. Delivering the first Albert Plesman Memorial Lecture at Delft, Holland, Pearson said his company's Dart was the first aircraft engine to go into large-scale production for airline use without substantial prior military experience. Nor, is it likely that the Dart will be the last turboprop powerplant that will have to follow this pattern.

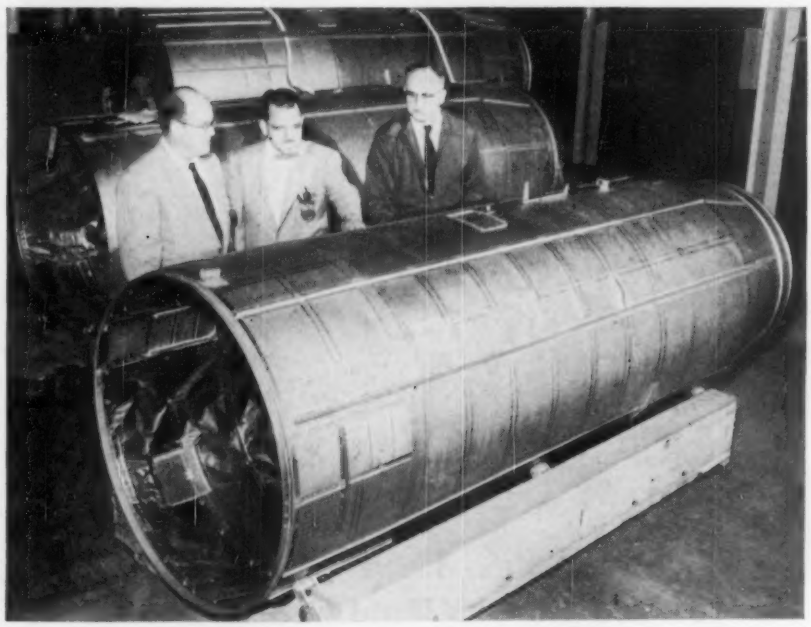
Teething Troubles

"This is unfortunate for the airline operators," Pearson says, "as it seems that they, and not the military, will have to go through the teething troubles of an entirely new engine." It would help if the military took the first production engines of a new series for use in a service transport, or use the civil-developed engines for their own non-transport uses, Pearson says. Since designers cannot rely on this happening, they must assume that turboprop development will continue to be a job for civil aviation for some time.

Pearson did not mention U. S. turboprop development, but undoubtedly was thinking of Military Air Transport Service's turboprop program, which involves the Allison T56 and the Pratt & Whitney T34. The T56 in its civilian version—Model 501 has been ordered to power American Airline's Lockheed Electras.

Development of the Rolls-Royce Dart, from the time the design was laid down in 1945 as a 1,000-hp. engine for a single-engine military trainer until delivery of the first production Dart 505 took about 12,000 hours on the bench. There were delays because this was the first turboprop engine to be taken through to production but Pearson says any future new civil engine will not take much less time.

"Any credit for getting cleverer and benefiting from past experience and the knowledge which has been accumulated is balanced by the fact that each

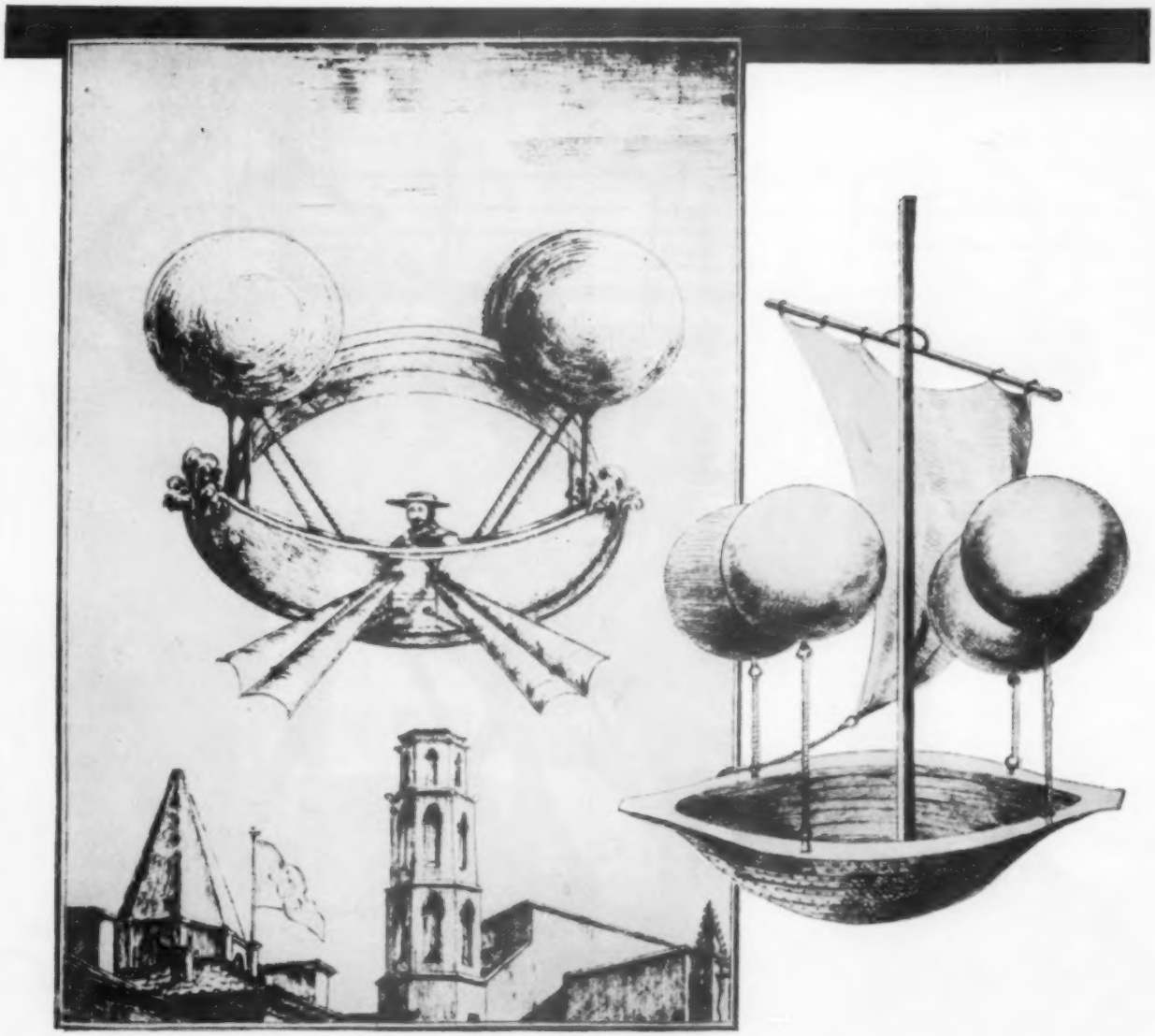


Dimpled Shroud for F-102A

Dimples and ridges rolled into titanium sheet at the forming mill will give greater rigidity and strength to the shroud used on the J57 turbojet engine that powers Convair's F-102A. The new technique also permits use of thinner titanium sheet. This, together with the replacement of rivets by seam and spot welds, cuts the shroud's weight. Convair-San Diego says the F-102A is the first airplane in which the dimpled titanium will be used.

MAN'S CONQUEST OF THE AIR

Lana's Flying Boat



Of the many ways by which men have tried to fly, here is one of the strangest. It involved pumping all the air out of four copper globes attached to a boat-like car. This aerial chariot was designed by Francisco Lana in Italy about 1670.

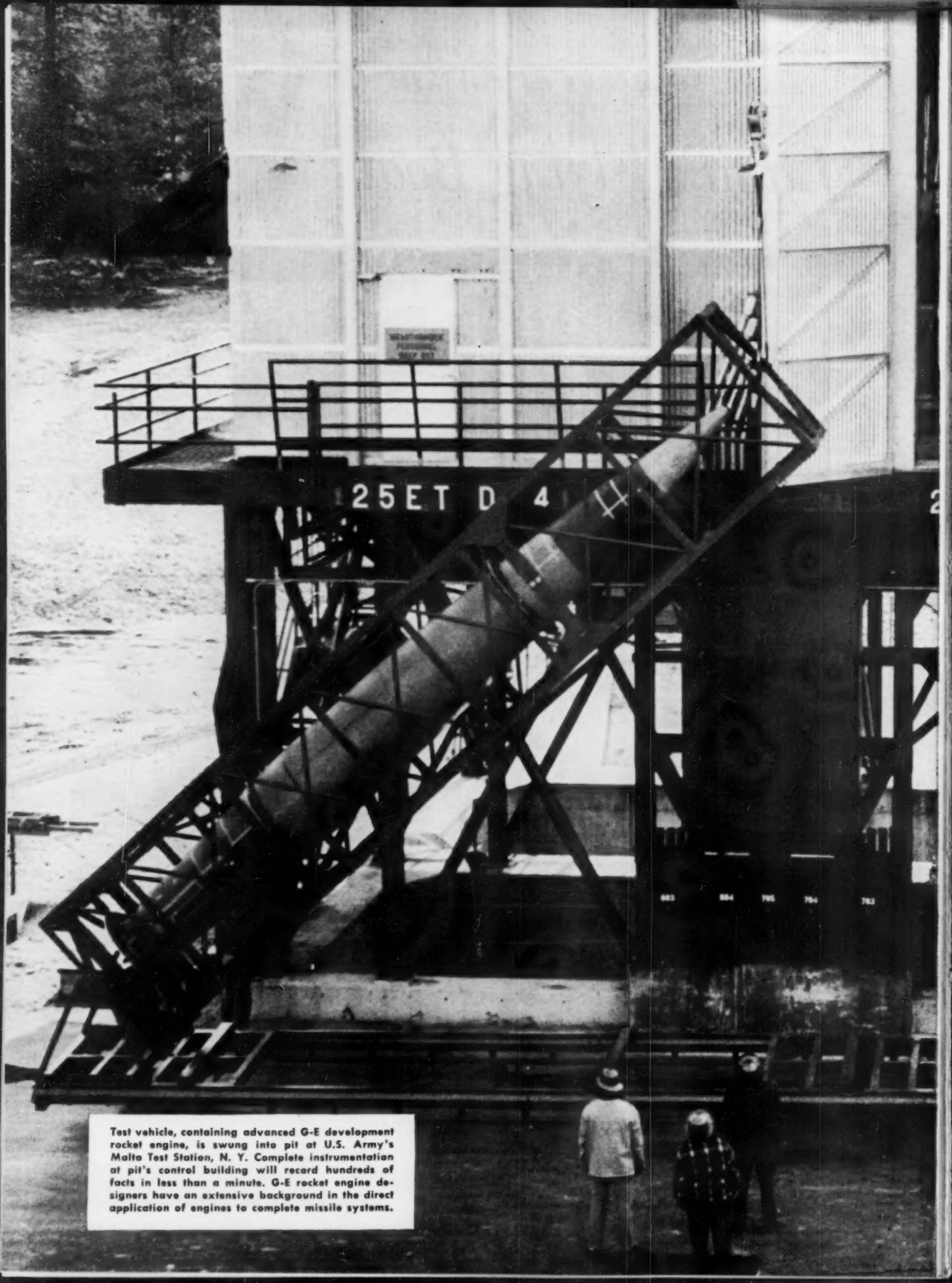
What Lana didn't know was the actual pressure and density of air, or he might have seen his error. Both of these were determined two years later. Even so, the idea still attracted attention nearly 200 years afterwards. In fact, a Frenchman, Marey Monge, actually built a machine from Lana's plans and tried vainly to fly it in 1843.

We may smile at Lana's flying boat now, but it was out of such trial and error that man finally flew. Today ESSO research, which has played an important part in the development of superior aviation petroleum products since the start of powered flight, is continuing to seek new and better ways to help men fly.

Another reason why most operators specify

ESSO

INTERNATIONAL AVIATION PETROLEUM SERVICE



Test vehicle, containing advanced G-E development rocket engine, is swung into pit at U.S. Army's Malta Test Station, N. Y. Complete instrumentation at pit's control building will record hundreds of facts in less than a minute. G-E rocket engine designers have an extensive background in the direct application of engines to complete missile systems.

ROCKET ENGINE PROGRESS AT GENERAL ELECTRIC

Weight Cut More Than 50% In NEW G-E Rocket Thrust Chamber

General Electric has tested an advanced rocket thrust chamber which weighs 50% less per pound of thrust than previous chambers of similar design. This marks another step in General Electric's continuing progress in developing better engines for the aviation industry. The significant weight reduction was achieved without compromising performance and reliability characteristics typical of G-E engines.

General Electric has been cutting rocket engine weight ever since G-E engineers ran the first U.S. tests on German V-2 engines in 1947. For example, the use of lighter materials and the transfer of start-up components from missile to ground are two weight reduction methods G.E. has pioneered. Experiments with new materials and new means of fabrication promise even more improvements on future engines.

Advanced Facilities Speed New Rocket Engine Development

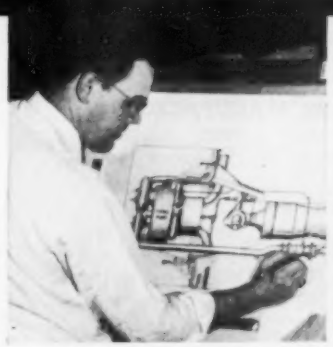
Today, General Electric is able to undertake a wide variety of rocket engine development work. The Company's rocket team, as an integral part of the Aircraft Gas Turbine Development Department, has access to the nation's most advanced privately-owned aircraft engine development facilities, as well as support from other G-E labs.

These facilities spell more and faster development progress for rocket engine programs and they underline G.E.'s increased capability for developing a wide range of rocket systems, subassemblies and components. To find out how General Electric can meet your specific rocket engine needs, contact a G-E Aircraft Specialist through your nearest G-E Apparatus Sales Office. 234-2

Progress Is Our Most Important Product

GENERAL ELECTRIC

ADVANCED ROCKET ENGINE DEVELOPMENT ACTIVITIES AT G.E.



OVER EIGHT YEARS' EXPERIENCE PER MAN is the record of G-E rocket engineers. This experience is now paying off in advanced powerplant designs under development.

STRONGER, LIGHTER ALLOYS being developed at G.E. will give rocket engines greater reliability, higher performance. A technician at the Company's Materials Laboratory checks a new alloy for tensile strength.

PREDICTING ADVANCED G-E ENGINE PERFORMANCE with electronic computer cuts development time, enables G-E engineers to ascertain optimum design characteristics of engines still on the drawing board.

G-E Facilities Available to Support Rocket Engine Programs:

- Component Development Laboratory
- Materials Laboratory
- Research Laboratory
- General Engineering Laboratory
- Combustion Laboratory
- Metals and Ceramics Laboratory

BOEING B-47, 6-JET BOMBER, at the Georgia Division, Lockheed Aircraft Corp., Marietta, Georgia, serviced by G-E Frequency Changer Package that supplies ground power for testing of electrical control and equipment for radar, radio, and electrical systems.

LOCKHEED AIRCRAFT CORPORATION REPORTS . . .

"G-E GROUND POWER UNITS GIVE US COMPLETE DEPENDABILITY"

43 G-E FREQUENCY CHANGERS NOW IN USE AT MARIETTA, GEORGIA PLANT

Four years ago, Lockheed's Georgia Division purchased their first G-E frequency changer. They were looking for a portable ground power unit to furnish 400-cycle current with close voltage regulation and complete reliability. Results were so satisfactory with this first unit that they immediately placed an order for 20 additional units. Since then, General Electric has delivered 22 more Frequency Changers to Lockheed, bringing the total in use at Marietta to 43. They are used in the laboratory developing and testing new devices; on the factory floor where manufacturing, assembly, and modifications are in progress; and on the flight line for checking instruments and electronic equipment.

V. O. CAMPBELL, ELECTRONIC STAFF SPECIALIST AT LOCKHEED says, "We have found in G-E Frequency Changers the high degree of accuracy and complete reliability necessary in the assembly and testing of the B-47s which we are building for the Strategic Air Command of the U.S. Air Force."

PIONEERS IN DEVELOPING AND MANUFACTURING aviation equipment and ground power supplies, General Electric is prepared to help solve *your* problems. G-E Aviation Specialists are ready to assist you by specifying standard units which will serve your needs, or engineering proper equipment for specific conditions. For further information, contact your nearest G-E Apparatus Sales Office, or write General Electric Co., Section 814-3, Schenectady 5, New York.

GENERAL ELECTRIC

succeeding engine gets more complicated and more difficult," Pearson points out. As an example: The Dart has 12,000 parts; the new R B. 109 has 20,000 parts.

Indicative of the progress in turboprop development, the R.B. 109 gives nearly three times the horsepower of the first service Darts, without increasing overall diameters and with only 50% greater weight.

Flight Endurance Tests

Flight endurance testing is a major problem with an engine which has no prior military background. The Dart accumulated 14,500 hr. before the first Viscount transport went into regular passenger service. Most–9,000 hr.–was done on the two Viscount prototypes.

Two BEA Dakotas, fitted with Darts, operated 4,000 hr. as freighters. Pearson finds endurance flying by an airline operator the most valuable form of testing.

Supersonic speeds and high altitudes present engine designers with new problems. Flight testing is restricted by weather conditions, lack of suitable aircraft at the stage of the development program when the tests are most needed, restricted risk that can be taken with a flight engine, and the difficulty of making sufficient quantitative test observations in flight.

The alternative is a ground test faility capable of simulating the desired conditions for a complete engine. Rolls is building one with its own funds. The new facility will have a wind tunnel capable of testing models to Mach 4, and be able to handle full-scale combustion tests at high and low pressures, and full-scale compressor test.

Performance Improvement

The turboprop engine lends itself very well to continued performance development, Pearson points out. Improvements in turbine and compressor efficiency show up in magnified form as shaft horsepower–the difference between the power developed by the turbines and the power required to drive the compressor. For example in an engine like the Dart, if the turbines develop 4,500 hp. and the compressor takes 3,000 hp., shaft horsepower is the difference, or 1,500 hp. A 1% improvement in turbine efficiency raises turbine horsepower to 4,545 hp., equal to a 3% increase at the shaft, where horsepower is raised to 1,545 hp. Similarly a 1% increase in compressor efficiency shows up as a 2% increase in shaft horsepower.

Another way of improving the power and reducing specific fuel consumption of turboprop engines is by raising the cycle temperature. Intensive development now proceeding on air cooled turbine blades and air cooled nozzle guide vanes will lead to continuous performance improvement of existing turboprop engines for some time to come, according to Pearson.

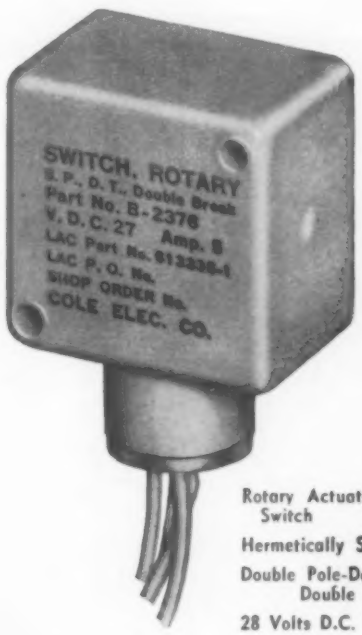
In turbojet engines, increase in temperature has no such effect on performance. The thermodynamic efficiency of the cycle increases with temperature is more than offset by the decreasing propulsive efficiency of the jet, Pearson points out. The optimum specific fuel consumption is obtained at a much lower flame temperature at subsonic forward speeds than that at which the engine must be designed for good thrust/weight ratio.

However, improving the efficiency of components or raising the compression ratio by adding stages to the front or rear of the compressor will improve the specific fuel consumption of the jet engine. In one engine, specific fuel consumption has been reduced 8% through these methods, according to Pearson.

The by-pass engine, described as a "half-way house" between the turobprop and the turbojet, can take advantage of higher temperatures, combining the better efficiency obtained at a higher turbine inlet temperature with the improved propulsive efficiency derived

Cole Electric Co.

8439 STELLER DRIVE • CULVER CITY, CALIFORNIA • TEXAS 8-4701



Rotary Actuated Limit Switch

Hermetically Sealed

Double Pole-Double Throw-Double Break

28 Volts D.C. 5 Amperes

DESIGNING, ENGINEERING AND PRODUCTION FOR THE AIRCRAFT INDUSTRY

- Switches
- Heaters
- Intervalometers
- Frequency Relays
- Power Relays
- Transformers
- Rectifiers
- Rocket Releases
- Rocket Indicator Switches
- Bomb Racks
- Air Circuit Breakers
- Oil Circuit Breakers
- Switch Housings
- Throttle Switches
- Limit Switches
- Switchboards

. . . and many other products. Specialists in hermetic sealing. Write us regarding your requirements.

EVER LAND A JET ON A

U.S. NAVY'S TOUGHEST PILOT-TRAINING PROBLEM MADE EASIER BY WORLD'S SAFEST JET TRAINER.

LOCKHEED **T2V-1**

Once you try it, you know there's nothing trickier than setting down on a carrier at jet landing speed. Add fickle winds to a pitching, yawing, rolling deck, and there's plenty to think about, especially during early training.

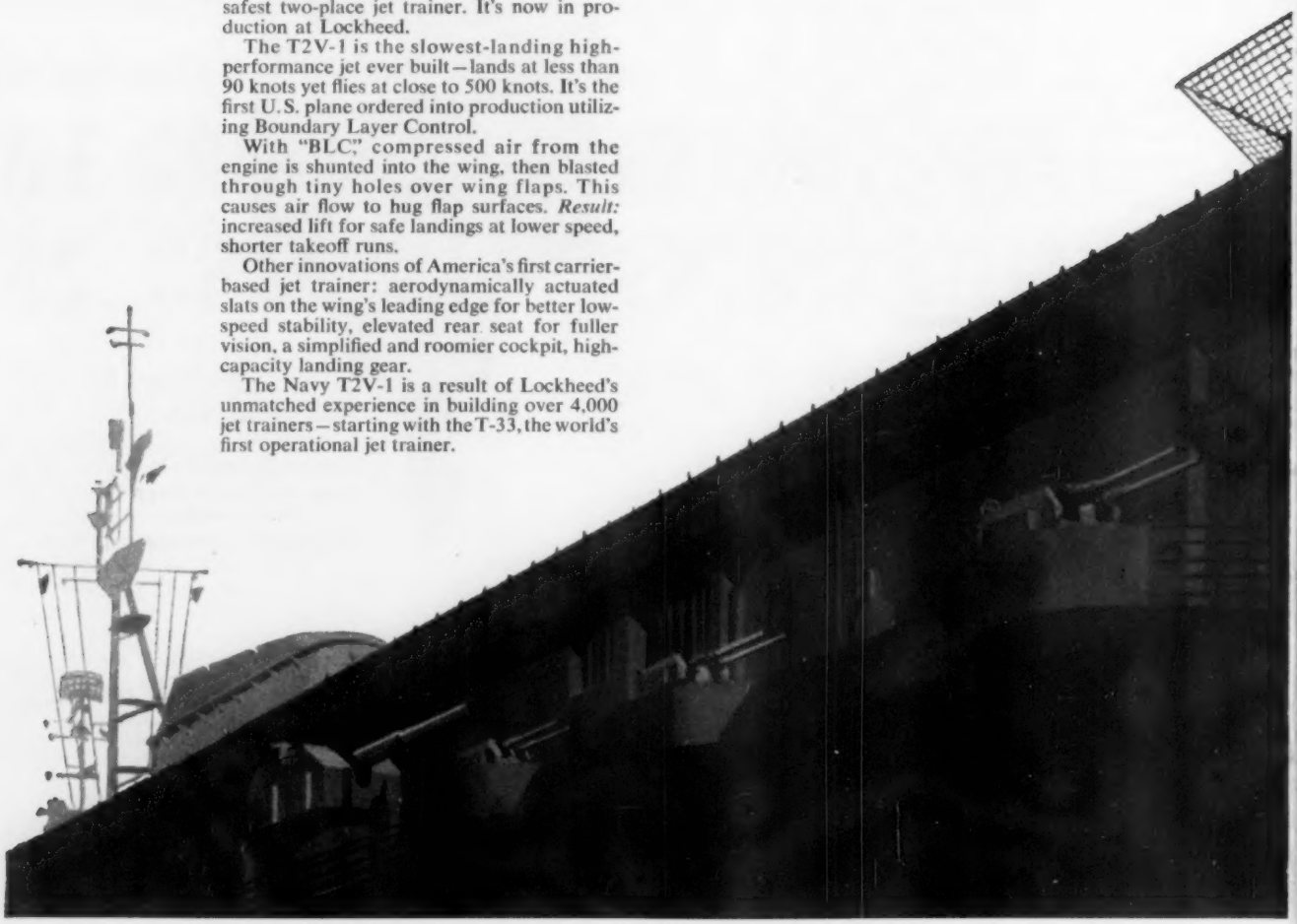
That's why the Navy needed the world's safest two-place jet trainer. It's now in production at Lockheed.

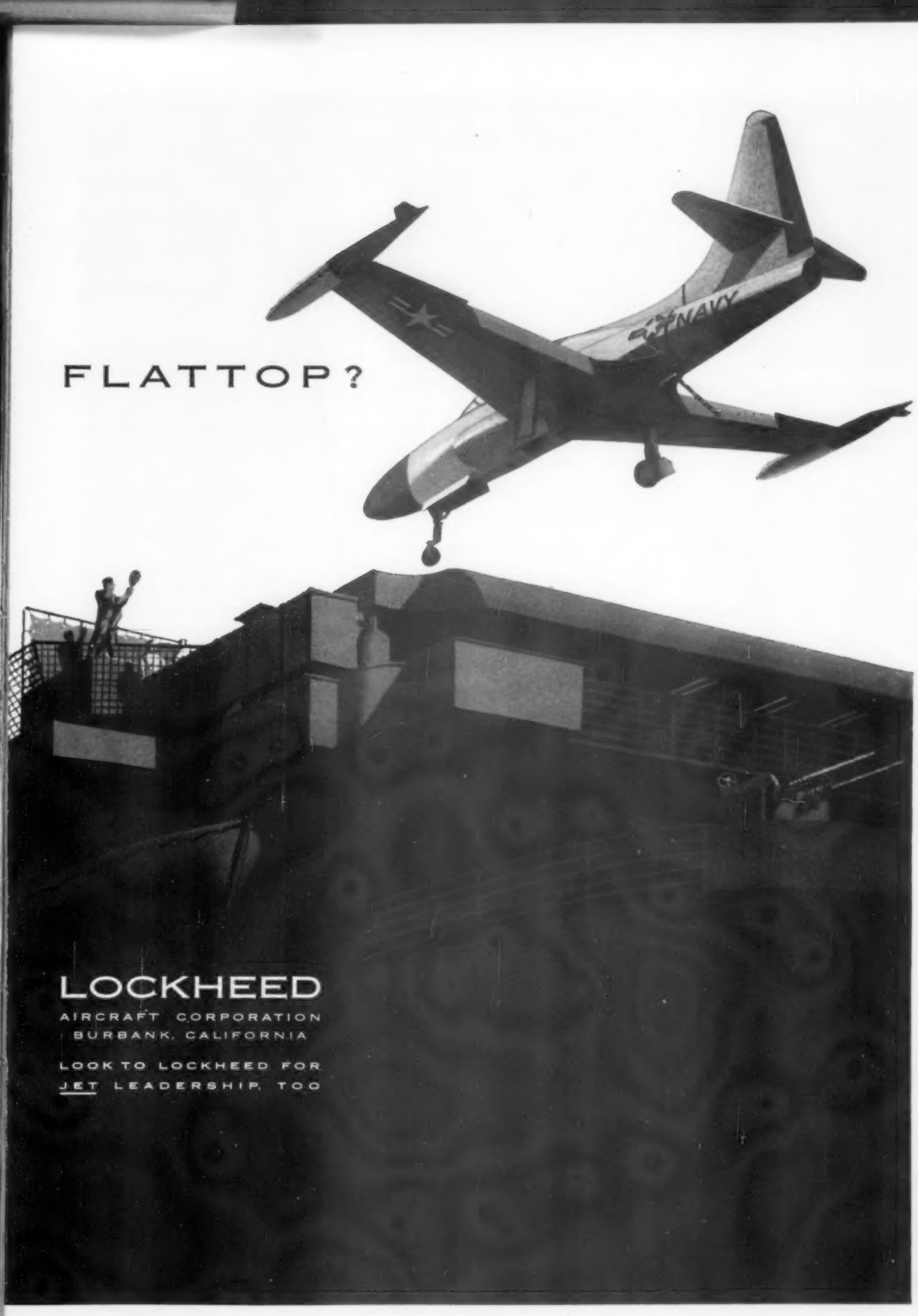
The T2V-1 is the slowest-landing high-performance jet ever built—lands at less than 90 knots yet flies at close to 500 knots. It's the first U.S. plane ordered into production utilizing Boundary Layer Control.

With "BLC," compressed air from the engine is shunted into the wing, then blasted through tiny holes over wing flaps. This causes air flow to hug flap surfaces. *Result:* increased lift for safe landings at lower speed, shorter takeoff runs.

Other innovations of America's first carrier-based jet trainer: aerodynamically actuated slats on the wing's leading edge for better low-speed stability, elevated rear seat for fuller vision, a simplified and roomier cockpit, high-capacity landing gear.

The Navy T2V-1 is a result of Lockheed's unmatched experience in building over 4,000 jet trainers—starting with the T-33, the world's first operational jet trainer.



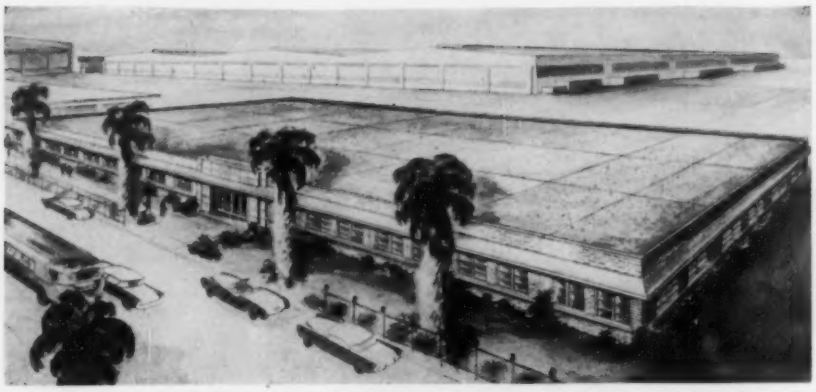


FLATTOP?

LOCKHEED

AIRCRAFT CORPORATION
BURBANK, CALIFORNIA

LOOK TO LOCKHEED FOR
JET LEADERSHIP, TOO



Goodyear Aircraft Expands Engineering Facilites

A multi-million-dollar engineering expansion program at Goodyear Aircraft Corp. includes the new electronics' engineering building illustrated here now being constructed at Litchfield Park, Ariz. (AW Aug. 1, p. 7). The one-story brick-and-masonry structure, 60x200 ft., is expected to be ready by the end of the year. Another larger facility—a $3-million engineering and research building planned for the company's Akron center—will be three stories high and measure 400x125 ft. When it opens next summer, this unit will be devoted to research and development in aerophysics and electronics. Both new structures are to be fully air conditioned.

from a lower jet pipe temperature. This gives the by-pass its advantage over the turbojet in specific fuel consumption.

Reverse Thrust

A single-shaft turboprop design, such as the Dart, can provide significant amounts of reverse thrust. Since it handles a large amount of excess air—six times as much as a piston engine with the same power, Pearson says—it has a large pumping power consumption. By allowing the propeller to windmill and drive the compressor, a considerable amount of drag is available during the highspeed part of a landing run. Although this is reduced considerably when the aircraft slows down, it appears to represent a reasonable solution for aircraft of the size powered by the Dart, Pearson says.

With two-shaft turboprop engines, where the propeller is connected to only one of the shafts, available drag is reduced, and a reversible propeller such as used on piston aircraft will be needed.

New Alloy Solving Engine Problems

Use of new N-155 alloy nozzle boxes and collectors seems to be eliminating the chronic problem of nozzle box cracking in Wright 972-TC18-DA3 turbo compound engines that power Trans World Airlines' fleet of Super G Constellations.

Since installation of the new nozzle boxes began last August, unscheduled removal rates of turbines and their components have dropped considerably. TWA figures show that during July, removals of turbines or their components on a fleet of 19 aircraft, came to 226; of these, 156 were removed due to nozzle box cracking.

Corresponding figures for August were 201 and 128, yet the airline flew 1,000 more engine hours.

TWA spokesmen say that of the "several" N-155 units already flying in August, two had to be removed for repair.

The new type nozzle boxes are being installed fleet-wide on an "on-condition" basis.

Rocket Fire Detector

A new rocket fire detector has been designed to detect an incipient, inadvertent rocket ignition in one-half-thousandths of a second and operate the release mechanism in time to eject the missile from the plane before it can ignite the airframe with its 3,000C blast.

Called the Fireye rocket detector and developed by Electronics Corporation of America, the small, quarter-pound unit has been tested by a large airframe manufacturer.

Test experiments have shown that small rockets will burn through steel aircraft structure in less than 400 milliseconds, making it imperitive to eject spuriously-ignited rockets from the plane almost instantly.

This is how the detector works:

A lead sulphide photoconductive cell, developed by ECA for its new aircraft explosion and fire extinguishing systems, detects incipient infrared radiation of a spuriously-fired rocket. The cell's resistance to a constantly applied dc. voltage drops in a fraction of a thousandth of a second. Resist-

To the ENGINEER of high ability

AiResearch is looking for your kind of engineer. Through the efforts of engineers like yourself our company has become a leader in many outstanding aircraft accessory fields. Among them are: air-conditioning and pressurization, heat transfer, pneumatic valves and controls, electric and electronic controls, and the rapidly expanding field of small turbomachinery. AiResearch is also applying this engineering skill to the vitally important missile accessory field.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability.

Positions are now open for aerodynamicists... mechanical engineers... physicists... specialists in engineering mechanics... electrical engineers ...electronics engineers.

For further information write today to Mr. Wayne Clifford, THE GARRETT CORPORATION 9851 S. Sepulveda Blvd., Los Angeles 45, California. Indicate your preference as to location between Los Angeles and Phoenix.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Scientific irritation for actuators

"Jitters" test in lab insures dependable operation in flight

Half a million AiResearch actuators have proved in the air the thoroughness of their manufacturer's test program.

One reason why they can be depended upon for flawless performance: they have been lab-tried beyond any limits they will ever have to meet in the field. Tests include vibration, altitude, heat and cold, load, sand and dust, immersion, temperature shock, oil spray, shock acceleration, fungus, humidity, explosion, salt spray and radio noise. They are undertaken in the finest test facilities of their kind in America.

AiResearch actuators are available for every possible aircraft requirement. You can depend on them and on all other aircraft accessories manufactured by AiResearch.

Qualified engineers in the fields listed below are needed now. Write for information.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

OFFSHORE HELICOPTERS—Humble Oil Company's drilling projects in the Gulf of Mexico are being served by three new Sikorsky Aircraft S-55 helicopters. For over-water operations, the helicopters are equipped with special flotation gear. Dependable Sikorsky S-55s, which avoid the hazards of surface transportation, have proved to be highly successful carrying drilling crews, special personnel and equipment between the mainland and offshore rigs.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

SONAR DUNKER—Versatility of Sikorsky helicopters is again being demonstrated in the Atlantic, where Navy HO4S helicopters now perform anti-submarine missions. By dunking or trailing special sonar gear, the HO4S is prepared to make a major contribution to the job of finding and killing enemy submarines. This HO4S, with rotor blades folded, is pictured aboard the USS Leyte.

COPTERS FOR CANADA—Sikorsky HO4S helicopters are now serving with the Royal Canadian Navy. The first aircraft of an additional order of ten is pictured here during brief delivery ceremonies. Sikorsky helicopters, both military and commercial, are widely used in Canada. The dependable transportation they provide in a wide variety of jobs is especially important in Canada's wilderness areas.

H-34s AT WORK—New Sikorsky H-34 transport helicopters are now on the job at Army aviation centers. Here a group of 12 combat-equipped soldiers at Camp Rucker, Alabama, trains with one of the big helicopters, which are larger and more powerful than the widely-used Sikorsky H-19s. The new helicopters are also built as the Navy's anti-submarine HSS and will also be available as a 12-passenger commercial S-58.

HELICOPTER HISTORY:

FIRST ARMY FLIGHT OF THE VS-300

In July, 1940, the first Army pilot flew a Sikorsky helicopter. He was Capt. H. F. Gregory (now Brig. General), pictured here in the experimental VS-300.

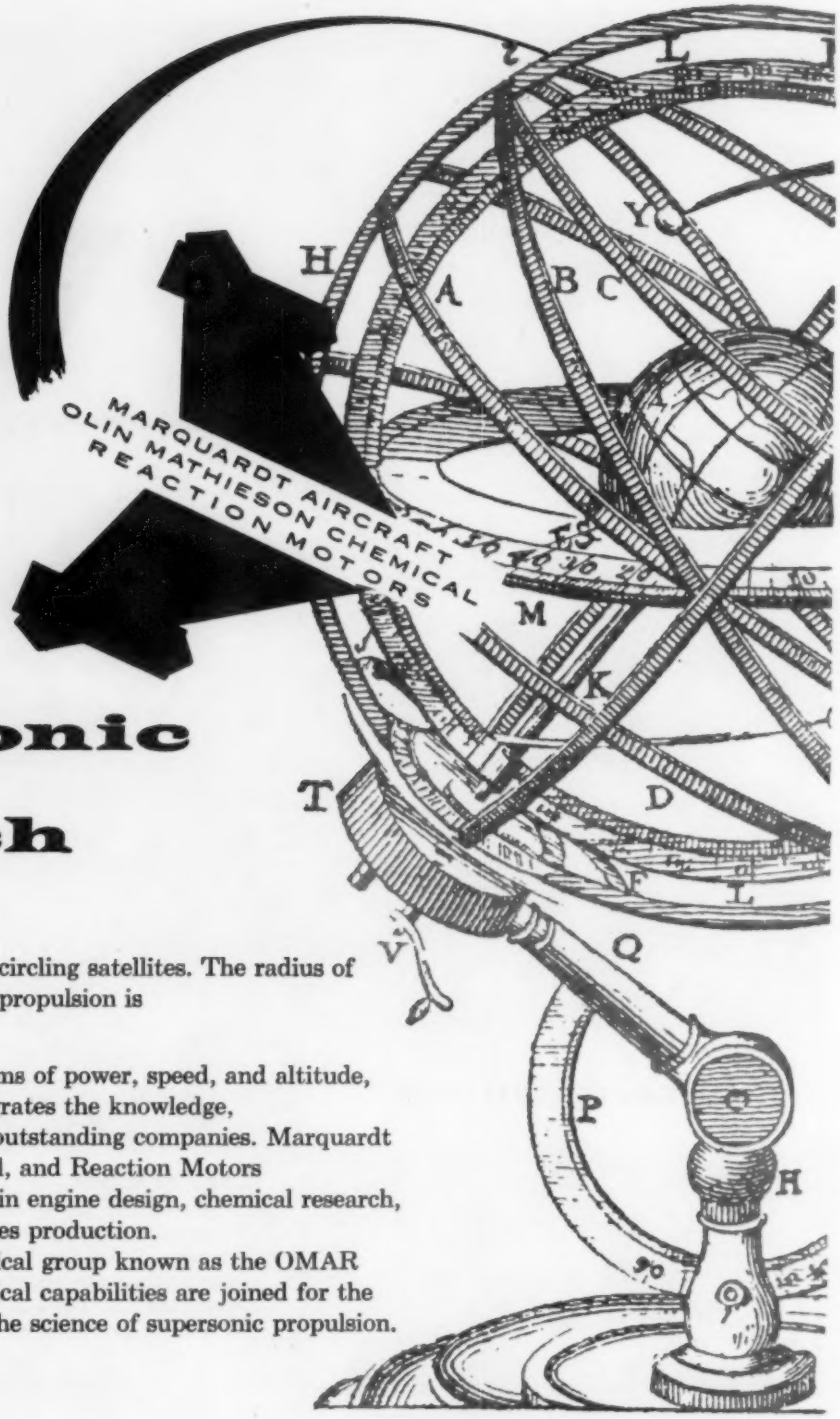
This historic aircraft, America's first truly successful helicopter, led to the manufacture of Sikorsky R-4s, with which the Army Air Corps pioneered helicopter operations during World War II.

SIKORSKY AIRCRAFT

BRIDGEPORT, CONNECTICUT

One of the Divisions of United Aircraft Corporation

new orbit for supersonic research

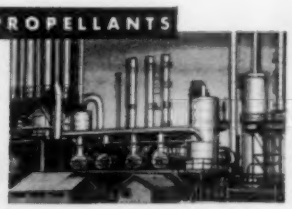


Aircraft . . . missiles . . . now earth-circling satellites. The radius of research in the field of supersonic propulsion is constantly being lengthened.

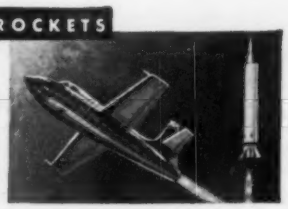
Spearheading an attack on problems of power, speed, and altitude, a unique new research group integrates the knowledge, experience, and facilities of three outstanding companies. Marquardt Aircraft, Olin Mathieson Chemical, and Reaction Motors bring together leading authorities in engine design, chemical research, metallurgy, chemical and explosives production.
Now coordinated through a technical group known as the OMAR Committee, chemical and mechanical capabilities are joined for the first time to add new impetus to the science of supersonic propulsion.

3360

Marquardt Aircraft Company



Olin Mathieson Chemical Corporation



Reaction Motors, Inc.

500°F AMBIENT SOLENOID

Ideal for high speed aircraft and missiles

This solenoid is designed to operate over a temperature range of −67° F to as high as a scorching 600° F, and over a voltage range of 14 to 30 volts d-c. Has a continuous life of 500 hours at 500° F, longer at lower ambients.

Special impregnation makes it unusually compact. Eliminated is the bulky insulation between turns common to other high-temperature units of this type. This impregnation also makes the coil impervious to salt spray and fungus. Design data includes:

Stroke	.156 inches
Coil Resistance	14.5 ohms @ −67° F
	21 ohms @ +70° F
	33 ohms @ +500° F
Force	1 pound minimum
Weight	0.7 pound
Operating Voltage	14 to 30 d-c

Other J&H high-temperature solenoids include a d-c unit having an .080-inch stroke and 3-pound force . . . an a-c unit with a .100-inch stroke and 3-pound force. Others can be created to answer your specific requirements. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Dept., 13 E. 40th St., New York 16, N. Y.

© 1955 by Jack & Heintz, Inc.

JACK & HEINTZ Rotomotive AIRCRAFT EQUIPMENT

ance drop is translated into a pulse and sent to a control section where it energizes a relay to operate the rocket release mechanism.

ECA said that in not one of the tests did the rocket exhaust cause damage to either the rocket package or the simulated aircraft structure.

The system can be installed anywhere it can operate at any place for maximum effectiveness.

Willow Run Gets Long-Life Pavement

A welded wire network embedded in asphalt is designed to increase the life of ramps and taxiways being resurfaced at Detroit's Willow Run Airport and cut down maintenance requirements. This is believed to be the first use of the "fabric-in-asphalt" process for major resurfacing of an airport.

The resurfacing was undertaken in order to improve and extend the life of the original pavement in some areas and increase its stability to carry plane loads of up to 75,000 lb., single wheel. Welded wire fabric reinforcement of the 3-in.-thick bituminous concrete was specified to reduce "reflective" cracking of the new surface over somewhat badly cracked unreinforced portland cement concrete slabs.

The original airport pavement built early during World War II is 6 to 8 in. thick but was not reinforced due to steel shortages. In certain areas 10x20 ft. slabs were requiring extensive maintenance of joints and cracks. The new resurfacing is expected to reduce maintenance cost by 70%.

Approximate cost of the project was $160,000, with Civil Aeronautics Administration putting up $80,000 to match the total of $40,000 each put up by Michigan State Department of Aeronautics and the University of Michigan. The university is owner of the facility, having purchased it from Defense Plants Corp. after the war.

The entire project, covering approximately 70,000 sq. yd. of pavement, required nearly 90 tons of welded wire fabric and about 14,000 tons of bituminous concrete, and was completed in 21 working days.

Turboprop Test Flights

Two Convair YC-131C turboprop transports have flown a total of 46 hr. 20 min. during a 24 hr. period. The air time was divided evenly between both planes. Aircraft, belonging to 1700th Air Transport Group, MATS, Kelly AFB, Tex., are fitted with Allison T56 turboprop engines and Aeroproducts Props. both YC-131Cs made four flights during the period.

NEW TYPE OVERVOLTAGE RELAY

Unaffected by environment... needs no rectifier

Easy adjustment to desired voltage limits, long life, reliability and simplicity are other features incorporated in this J&H overvoltage relay for aircraft. While designed primarily for J&H a-c control panels, it works equally well on any a-c system or control panel.

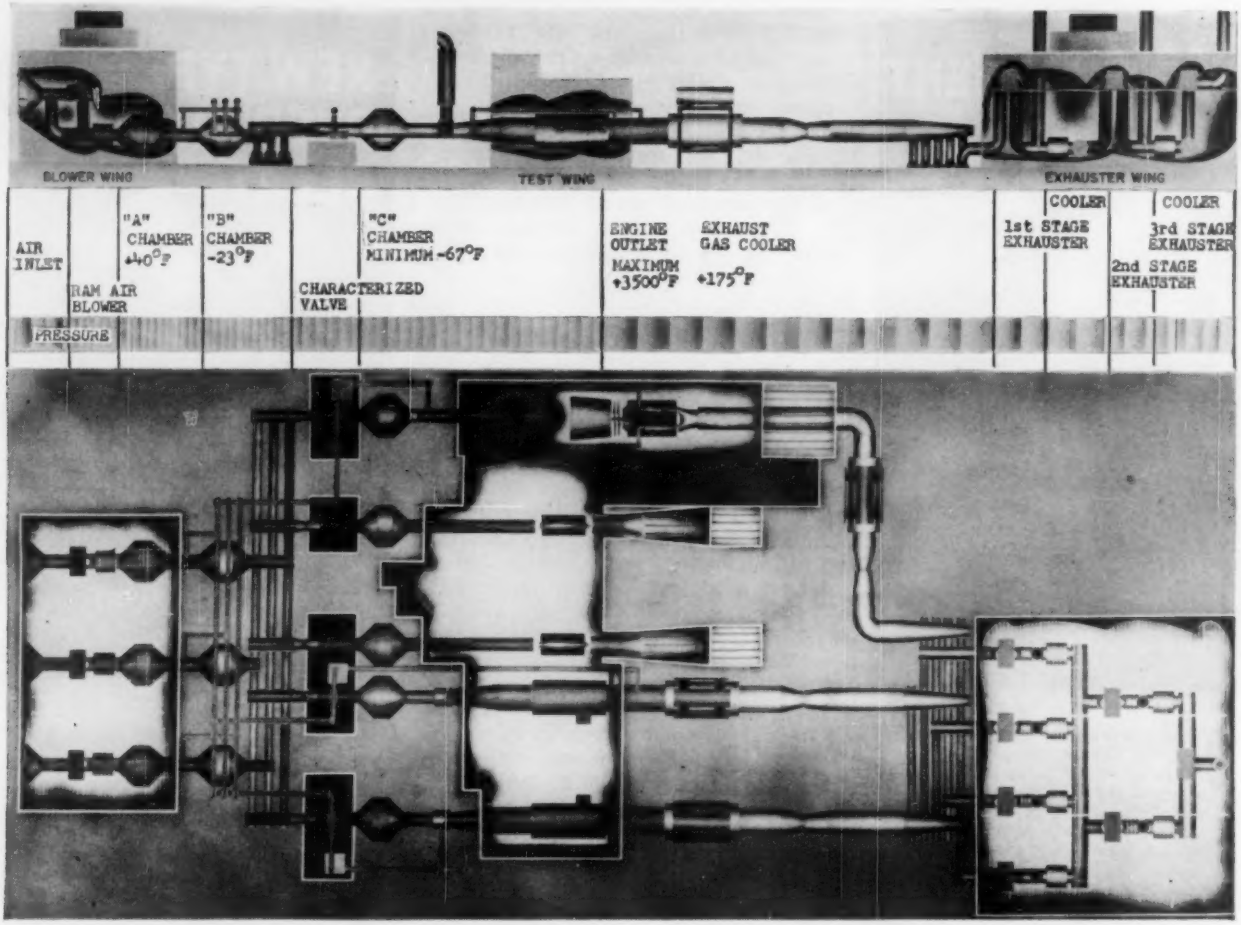
This "glow switch" relay offers the following improvements over present overvoltage relay circuitry:

- Calibrations unaffected by mounting position, altitude, or acceleration in any direction.
- Hermetic sealing prevents damage from humidity, fungus, dust and salt spray.
- A-c power is sensed direct; relay needs no rectifiers.
- Low stand-by power drain.
- Adjustable minimum trip voltage and time delay.
- Smaller and lighter over-all circuit.

For complete details, write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Dept., 13 E. 40th St., New York 16, N. Y.

© 1955 by Jack & Heintz, Inc.

JACK & HEINTZ Rotomotive AIRCRAFT EQUIPMENT



PLAN AND SIDE DRAWING of the Navy's $40-million gas turbine test laboratory shows layout of buildings and equipment.

Navy Opening Giant Engine-Test Facility

By George L. Christian

West Trenton, N. J.—U. S. Navy officials this week are making final preparations for the official opening on Nov. 4 of the new Navy Aeronautical Turbine Test Station—in all probability the world's most complete and powerful facility built specifically for wringing out experimental and prototype turbojets, turboprop, ramjet and pulsejet powerplants.

The $40-million Navy station can simulate altitudes from sea level to 65,000 ft., air speeds from near-sonic at sea level to supersonic at altitude and temperatures from −67 to 150F. In the near future, the high-temperature capacity will be pushed to 350F.

Provisions for silencing alone—for air intake and exhaust mufflers and sound attenuation equipment—cost more than $3 million.

Three Big Jobs

The 65-acre station is designed to conduct three types of testing:

• **Steady state tests,** which will comprise most of the work. This includes engine qualification and calibration testing.

• **Transient tests,** which will determine engine characteristics during acceleration and deceleration.

• **Environmental tests,** which will check engine performance under various severe climatic, temperature and altitude conditions.

The gas turbine engine research and test facility must always be a good jump ahead of industry so there will be no delay in investigating new powerplant developments, Capt. J. E. Dodson, commanding officer of NATTS, pointed out to Aviation Week.

As an example, one of the five test cells recently finished is the only test rig known to Navy that is capable of subjecting complete turboprop engines to wide extremes of altitude and temperature. It contains an inlet throat with a variable orifice which can be adjusted to a wide range of propeller diameters.

Under active study is an "attitude test cell" designed to help solve power control, lubrication and bearing problems associated with powerplants for VTOL aircraft. This structure would accommodate a complete turbojet or turboprop powerplant in any position from horizontal through vertical.

1 Million Cfm.

To simulate ram air conditions met by jet engines, massive machines move huge amounts of air—total compressor capacity is 1 million cfm.—through the facility's trio of buildings, the blower, test and exhauster wings. The structures were erected in a straight line to minimize air flow pressure losses. Total air flow distance is 700 ft.

Air is drawn into the compressor wing and rammed through 48-in. headers to 23-ft.-dia. intercoolers. Here it is warmed or cooled to simulate heat of ram temperature rise or cold of stratospheric flight.

Headers are lined with stainless steel sheet to prevent corrosion, as flake-off could damage engines under test.

Out-size "characterized" valves, which are highly sensitive devices with

rapid response and low pressure drop, regulate the air flow.

Air is then blasted to the test cells. After passing through the gas turbine engine which is under test, temperatures (if afterburner is used) may reach 3,500F. This is quickly dropped to 175F by special coolers to avoid heat damage to equipment in the exhauster wing. There three stages of blowers suck air away from test cells to simulate high altitude conditions.

Large capacity refrigeration equipment and a separate heater system make it possible to cold-soak powerplants to −67F to test cold starting and Arctic operating conditions.

Power consumption of the station will begin at 40,000 kw., soon increase to 50,000 kw. and eventually jump to 100,000 kw.

With all the machinery in operation, the test facility has a connected working load of almost 100,000 hp.

Control Center

Heart of the test station is a supervisory control room built on the front of the test wing.

Here, a 35-ft. central control panel equipped with lights, dials, gages and controls allow engineers to supervise the functioning of every part of the laboratory, give permission to operate equipment, and direct air flow.

Controls were designed and installed by Minneapolis-Honeywell Regulator Co. and include more than 23 miles of copper tubing plus 26 miles of thermocouple wiring which focus vital information from all parts of the laboratory on the panel for the engineers to read.

Controls are of the "permissive" type —manual on-off interlocks which prevent any part of the laboratory's machinery from being started until all operating requirements have been satisfied.

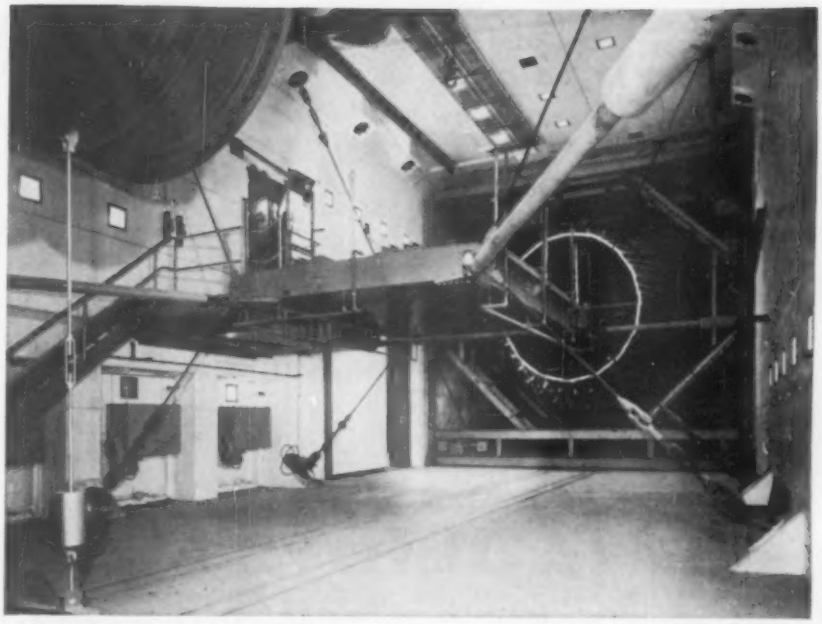
Engineers do not control any of the machinery, they merely give permission to on-the-spot operators to set it in motion. They act as coordinators to assure that all parts of the complex laboratory function as a team.

Any emergency can be spotted immediately in the supervisory control room and pushing a single button can shut down the entire shop.

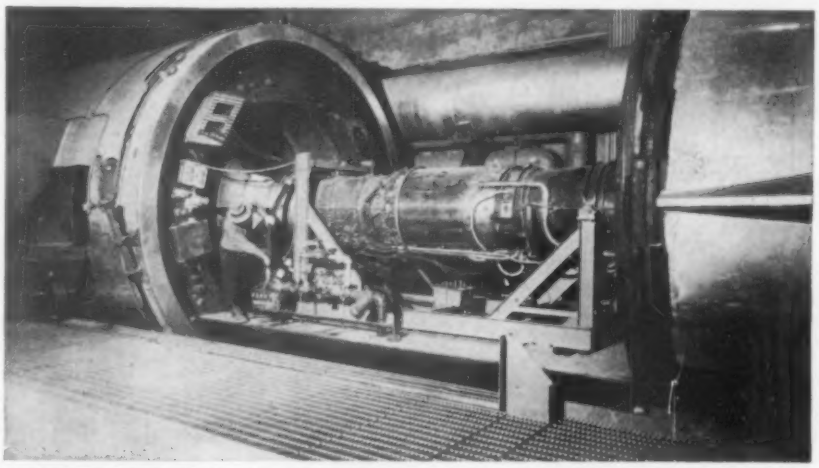
Laboratory personnel in individual sound-proofed control centers located close to each test cell operate the engines, watching the tests both through elaborate instrumentation and physical observation.

The indicators on the control room panel check 348 temperatures throughout the facility. Three hundred other temperatures are easily verified by a standard dial telephone which incorporates a special check system.

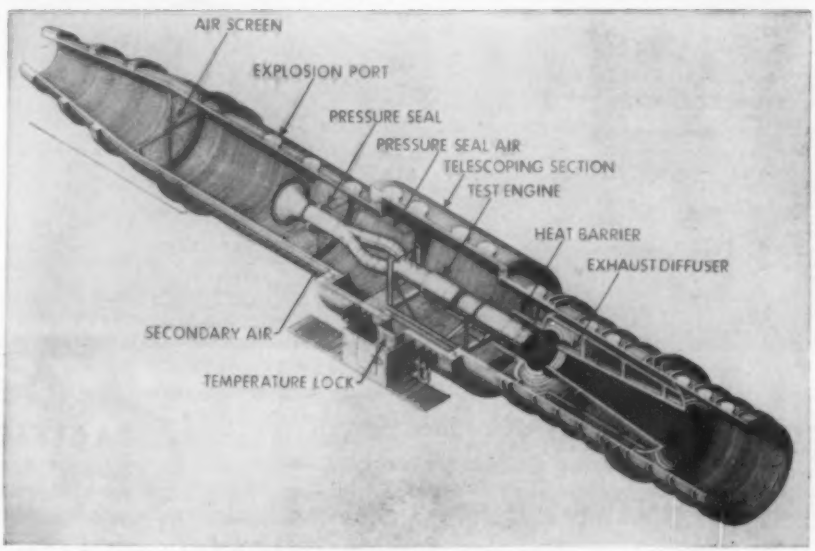
Operating personnel can communi-



TURBOPROP test cell with engine platform in center, variable orifice inlet throat at right.



ALTITUDE TEST CELL. Open telescoping section shows T-40 turbojet being installed.



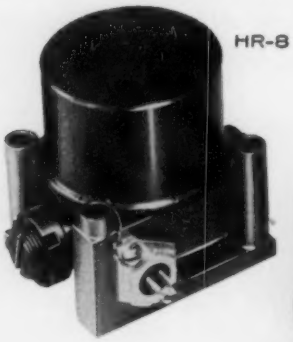
CUTAWAY drawing of altitude test cell shows principal features and air flow.

BENDIX-PACIFIC

HIGH RESPONSE

HYDRAULIC SERVO VALVES

GREATER NULL SHIFT STABILITY AT WIDER TEMPERATURE RANGES WITH EXCEPTIONAL RELIABILITY



HR-8

HR-9

SPECIFICATIONS	HR-8	HR-9
RATED FLOW:	2.8 G.P.M. at 1500 P.S.I. Press. Drop and 6 MAΔI	4 G.P.M. at 1500 P.S.I. Press. Drop at 8 MAΔI
GAIN:	.46 G.P.M. Per MAΔI	.5 G.P.M. Per MAΔI
OPERATING CURRENT:	4 MA Quiescent	4 MA Quiescent
OPERATING PRESSURE:	1500 P.S.I.	3000 P.S.I.
LEAKAGE:	.15 G.P.M. Max. (None External)	.15 G.P.M. Max. (None External)
NATURAL FREQUENCY:	250 CPS	250 CPS
DITHER:	None	None
COIL:	Concentric Double Wound.	Double Wound. Equal Resistance Windings

HR-10

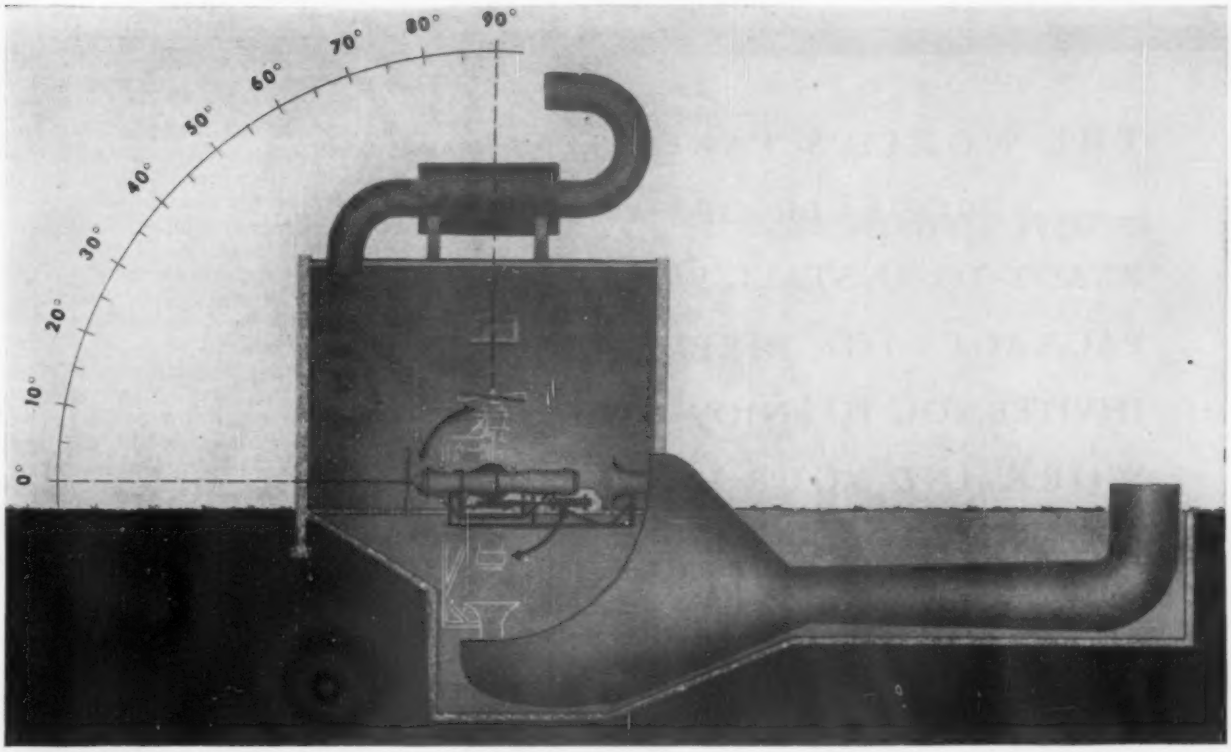
HR-11

SPECIFICATIONS	HR-10	HR-11
RATED FLOW:	.4 G.P.M. at 3000 P.S.I. Press. Drop and 8 MAΔI	.4 G.P.M. at 3000 P.S.I. Press. Drop and 20 MAΔI
GAIN:	.05 G.P.M. Per MAΔI	.02 G.P.M. Per MAΔI
OPERATING CURRENT:	4 MA Quiescent	10 MA Quiescent
OPERATING PRESSURE:	3000 P.S.I.	3000 P.S.I.
LEAKAGE:	.10 G.P.M. Max. (None External)	.10 G.P.M. Max. (None External)
NATURAL FREQUENCY:	160 CPS	160 CPS
DITHER:	None	None
COIL:	Double Wound. Equal Resistance Windings	Double Wound. Equal Resistance Windings

Write us regarding
your Servo Valve problems.

Bendix
PACIFIC DIVISION
Bendix Aviation Corporation
NORTH HOLLYWOOD, CALIF.

EAST COAST OFFICE: 475 5th AVE., N.Y. 17 • **DAYTON, OHIO**—1207 AMERICAN BLDG., DAYTON 2, OHIO • **WASHINGTON, D.C.**—SUITE 803, 1701 "K" ST., N.W.
CANADIAN DISTRIBUTORS: AVIATION ELECTRIC, LTD., MONTREAL 9 • **EXPORT DIVISION:** BENDIX INTERNATIONAL, 205 E. 42nd ST., NEW YORK 17



ARTIST'S CONCEPTION of an "attitude test cell." Rendering shows a turboprop engine and the rack and pinion for rotating it to the vertical position (shown in phantom). Air is drawn in through intake and silencer on the roof, exhaust is underground.

cate with each other only by going through the control room. Control engineers can talk with personnel anywhere in the laboratory through a closed loop communications system.

Blower Wing

The blower wing houses three Ingersoll-Rand high-pressure centrifugal blowers.

Air is taken in through intake silencers and filters and is pumped through primary coolers which dehumidify and cool it to 40F. It then passes through secondary coolers which can lower the temperature to −23F.

Flooring in the blower wing is mostly open metal grating, supported by steel I-beams which are bolted to the building's primary structure. This makes it easy to pull out entire sections of flooring to facilitate installation of large new machines as they are needed.

Also housed in the blower wing are large Freon and brine machines and associated feeder lines.

From the secondary coolers, air passes into five headers, each having a characterized valve and 23-foot diameter intercooler. The valves may be actuated manually through a pneumatic system or automatically through an electrohydraulic control.

The intercoolers warm or cool air flowing to the test cells to simulate ram heat or altitude cold.

The test wing houses five test cells—two altitude chambers, two sea level test rigs and the turboprop test cell.

CHARACTERIZED valve has movable sleeve (center) to regulate air flow.

Each altitude test cell is a metal cylinder 65 ft. long and 15 ft. in diameter. The center section telescopes over the forward part to allow engine to be mounted on a thrust measuring stand inside the cell. After the engine has been installed and all fuel, ignition, control and instrumentation hook-ups made, the center section is positioned hydraulically and locked to both front and back segments by means of a mechanical, wedge-type lock. Specially designed inflatable rubber seals make fore and aft joints airtight.

A special partition, tailored to the

THE WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES INVITES YOU TO ENJOY YOUR WORK *AND* YOUR LIFE IN

beautiful SOUTHERN CALIFORNIA

We believe we can offer you an opportunity to improve your position in the business world—and improve your way of life here at Rohr Aircraft Corporation in beautiful, temperate, exciting Southern California. To strengthen our personnel in various departments, Rohr has a real opportunity for you if you are skilled as an —

ENGINEER
(Aircraft Design or Structures)
LOFTSMAN
JIG & FIXTURE BUILDER
TOOL PLANNER • TOOL DESIGNER

ROHR
AIRCRAFT CORPORATION

Please write giving complete details and we will answer immediately.
Mr. Ned DeWitt, *Personnel Department* 20
Rohr Aircraft Corporation
Chula Vista, California

9 miles south of San Diego on sunny San Diego Bay.

outside diameter of the powerplant being tested, seals the area between the forward part of the engine and the inner wall of the test cell. This diverts all blower air into the powerplant's intakes and prevents dilution of exhauster suction with ram pressure.

At present, the altitude cell will not handle jet engines equipped with afterburners because of the risk of destructive afterburner detonation. Plans are under way to install water spray curtains to break the detonation and eliminate this deficiency.

The cells can also be used to test engines with air under ambient temperature and pressure conditions. The center sections have air lock doors to permit entry during engine operation.

Deflection caused by mounting heavy jet engines on a cantilever platform about 30 ft. long creates an alignment problem between telescoping center section and fixed front and rear parts. Future altitude cells will have hinged instead of telescoping access sections.

Sea Level Tests

The sea level test cells can also operate on either conditioned ram air or ambient atmosphere and accommodate engines with or without afterburners.

Engine exhaust, instead of being evacuated by exhausters, is dumped into a sound attenuation chamber which deadens the loud roar to the level of an automobile exhaust.

Engine cradles are fashioned of hollow steel tubing. Provisions have been made to circulate cooling water through the tubing in case heat from the engine becomes too intense.

Four water spray rings are directly behind the engine to cool the exhaust and prevent its heat from damaging the sound attenuation material.

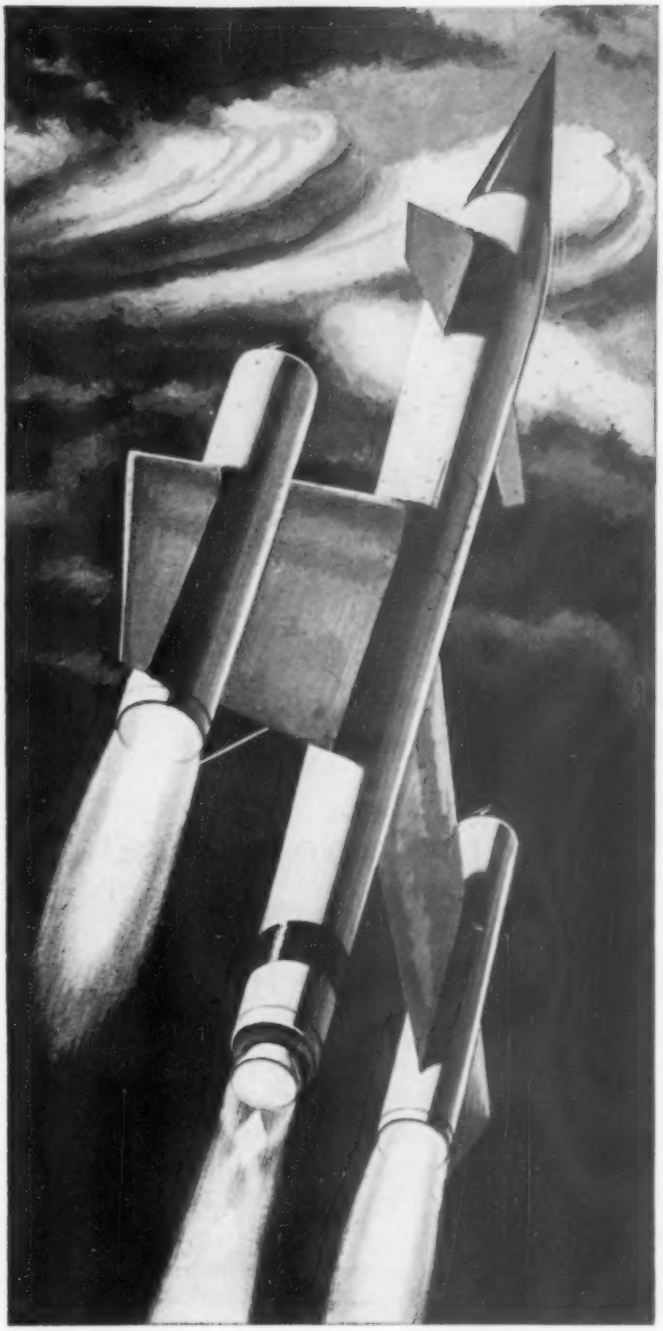
The automatic Minneapolis-Honeywell equipment cuts in the first spray ring when temperature reaches 380F. Successive rings go into operation as temperature climbs to 460F, at which point an alarm is sounded.

The turboprop test cell can test engines with conditioned or ambient air and under high-altitude conditions. Propellers turn in ambient air only.

Props draw in air through 30-ft.-high acoustical baffles and a variable-orifice inlet whose circumference at the propeller end can be adjusted from 9 to 20 ft. Purpose is to eliminate inlet buffeting around prop tips. The whole orifice structure can be moved back and forth to accommodate turboprop engines of different lengths.

Engine exhaust is drawn into the exhauster wing. Prop wash is blown through a sound-attenuation chamber where noise is reduced to a level equivalent to hearing the turboprop four miles away.

The engine is mounted on a cable-



a helping hand UP or OUT

McDONNELL F-101 VOODOO

Armament Jettisoning Developments by the Explosives Division of the OLIN MATHIESON CHEMICAL CORPORATION Have Proved to be Ideal Solutions to a Variety of Jet Age Problems.

Many tough missile and aircraft problems have yielded to speedy solutions with the specialized aid provided by Olin Explosives Division experts. Recently, new developments by leading aircraft manufacturers have greatly been expedited by the unmatched knowledge and know-how Olin automatically places at the disposal of a manufacturer. If there is a possibility that any of your own problems can be answered through a creative utilization of solid propellants or explosives, a call to East Alton today may well prove an important step to a rapid solution.

OLIN SOLID PROPELLANTS
ARE READY FOR USE IN THE
FOLLOWING APPLICATIONS

- Missile Propulsion Units, Boosters and Sustainers, ATO Motors
- Solid Propellant Turbo Jet Engine Starter Cartridges
- Gas Generators and Auxiliary Power Units
- Power Packages for External Stores, Canopies and Pilot Seats Forced Ejection Systems
- High Explosives, Ignitors, Fuses, Detonators, Flares, Pyrotechnics
- Explosive Formation of Metal Parts

Olin
TRADE MARK
EXPLOSIVES DIVISION
OLIN MATHIESON CHEMICAL
CORPORATION
EAST ALTON, ILLINOIS

the industry's choice for better fabrication...

AVIATION FABRICS

to specification by

Sawyer

...for highest quality canopy covers... interior trim... insulation

Backed by more than 100 years of extensive laboratory facilities in the hands of expert research engineers — SAWYER'S Coated Aviation Fabrics set the standard for the highest quality product available to the aircraft industry — vinyl-coated cotton, nylon, glass cloth and other synthetics. Contact your nearest representative or write us for samples of our Specialty Aircraft interior and exterior coated fabrics as well as our upholstery fabrics for interior trim with our Aircraft Finish — manufactured in all types, colors, weights and widths to government and AAF specifications.

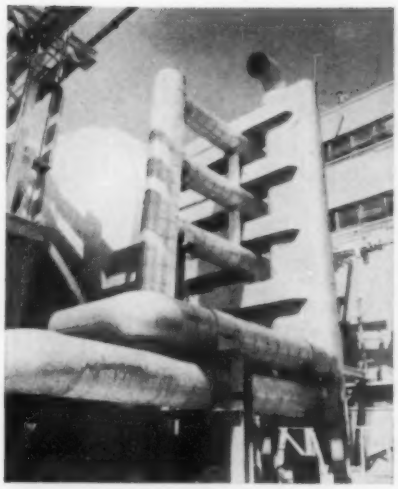
FROG BRAND ®

THE H. M. SAWYER & SON CO.

Coated Fabrics Division... Established 1840

WATERTOWN 72, MASS. WAtertown 4-0520

NEW YORK: Walter I. Schutt, 18 East 41st St., MUrray Hill 5-3611; William E. Mitchell, 15 West 26th St., MUrray Hill 6-8750
ATLANTA: Maurice E. Woods Co., 83 Cain St., N.E., CYpress 4218 **CHICAGO:** D. Russell & Co., 331 South Peoria St., TAylor 9-7471
CINCINNATI: Lee & Storrs, 2111 Carew Tower, CHerry 1-1844 **DALLAS:** W. L. Mellor Co., 1507 Dragon St., RAndolph 8479
DETROIT: E. J. Ewing, Inc., TRinity 1-4040 **KANSAS CITY:** W. L. Mellor Co., 2603 Warwick, GRand 6850
LOS ANGELES: John Sweeten, 516 South St., Andrews Pl., DUnkirk 7-2587 **SEATTLE:** R. C. King, Inc., 117 Madison St., SEneca 1740



LARGE-SIZE refrigeration piping leads to intercooler (left) and test wing (right).

supported stand which is equipped with a thrust-measuring mechanism.

In the area between the test cells and exhauster wing are three specially designed coolers—one for each of the two altitude chambers and one for the turboprop engine exhaust. They can knock temperatures from 3,500F down to 175F in the space of a few feet.

Exhauster Wing

The exhauster wing, which is currently being doubled in size and capacity, contains seven De Laval turbo-exhausters. In the first stage, four machines, each powered by a 4,500-hp. electric motor, can simulate altitudes up to 23,000 ft. In the second stage, two exhausters driven by 3,500-hp. motors, brings the altitude up to 44,000 ft. Third stage, a single exhauster requiring 3,000 hp., takes test cell altitudes to 65,000 ft.

Other equipment in the building includes silencing provisions, coolers and an extensive air circulation system to ventilate the building. All exhauster air pumping equipment is interconnected by large-diameter headers and air flow is controlled by over-size gate valves—some three stories high.

As in the blower wing, almost of the building's flooring is removable metal grating.

New Additions

Navy spokesmen sketched these additional details of expansions, either under way or planned, for NATTS:

• **Blower wing will be extended** to accommodate one additional blower and motor equal in capacity to each of the three now installed.

• **Altitude test cell** currently in the design stage will be somewhat larger than the two existing cells to handle large future engines. Associated equipment will also be able to create higher temperatures—up to 350F—to simulate ram heat rise. Design of the cell itself will differ from existing units in that hinging rather than telescoping action will open the chamber.

• **Environmental test cell** is being planned to submit gas turbine engines to a variety of severe climatic conditions.

• **Accessory test cell,** where engine accessories will be subjected to the same temperature and altitude extremes as the engines themselves, is in the planning stage.

Auxiliary Facilities

Auxiliary facilities of NATTS include a pumping station on the Delaware River two miles away, with capacity of 5,000 gpm. Water is pushed through a 20-in. main to a water treatment plant from which it is piped to a 1.2-million-gal. reservoir. Above the reservoir is a group of 12 water towers, each equipped with a large-diameter cooling fan. With normal ambient temperatures, each tower has a capacity of 5,000 gpm. and can drop water temperature from 135F to 90F. Sixty-inch reinforced concrete pipes bring water to the towers from the facility's various intercoolers, heat exchangers and exhaust coolers under a pressure of 100 psi.

Recirculation of cooling water through the towers means that the pumping station needs only to replenish water lost through evaporation.

NATTS also has an electric sub-station into which 13,200-v. current is piped through underground cables sealed in oil and nitrogen.

This newest Navy aeronautical test lab is under military command; technical coordination under the Commander, Naval Air Development and Material Center, Johnsville, Pa.; jurisdiction under the Fourth Naval District.

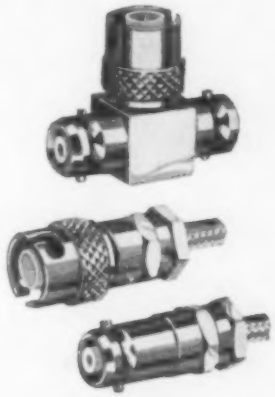
School Expands

Rio de Janeiro—The Institute Technologico de Aeronautica, Brazil's version of M.I.T. with the emphasis on aeronautics, has begun an important expansion program. New projects include an airport with two-and-one-half-mile-long landing strips, an all-concrete wind tunnel and an engine division using machinery from a World War II Packard Rolls Royce airplane engine factory in the U.S.

P&W Increases Space

Pratt & Whitney Aircraft plans to double the production space of its North Haven Conn., plant. The company expects the addition—500,000 sq. ft. of production floor space and 100,000 sq. ft. of office floor space—to be ready for occupancy by mid-1956.

One-Half the Size
One-Third the Weight
of the Standard BNC!

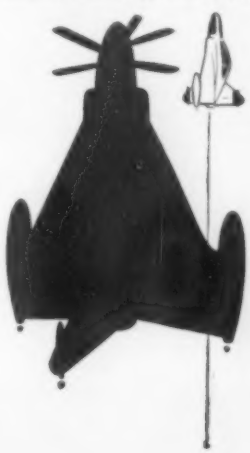


MINIATURIZED
NEW DAGE DM SERIES
COAXIAL CABLE CONNECTORS

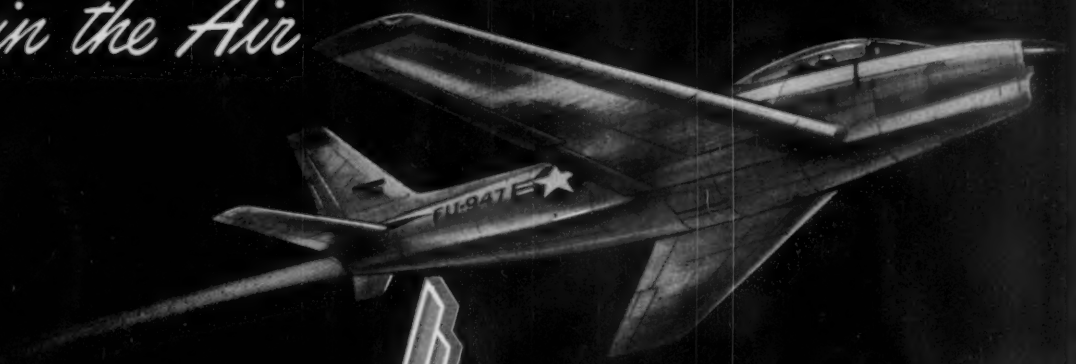
- weatherproofed and sealed
- quick disconnect
- vibration proof
- mechanically rugged
- withstand extreme temperatures
- heavy silver plating
- can be adapted to any miniature cable
- requires no special tools for assembly
- all general types available

Phone • Write • Wire for samples and detailed information

DAGE ELECTRIC COMPANY, INC.
BEECH GROVE, INDIANA



For SUPERIOR PERFORMANCE *in the Air*



For DEPENDABLE SERVICE CECO *in the Field*

Across the country, CECO's field service engineers are quickly available to assist our customers with expert application engineering and supply on-the-spot information. Acting as liaison between our West Hartford plant and aircraft and engine manufacturers everywhere, these specialists also bring important information from the field to our design and production departments that helps us anticipate and better meet the fast-changing needs of the aviation industry.

FOR A MORE COMPREHENSIVE PICTURE

of all the Chandler-Evans Pumps, Fuel Controls, and Accessories, send for your copy of the CECO Circular, "Engineered For The High And The Mighty . . ." or simply write outlining your fuel control problems. Our engineers will be glad to work with you to help build new standards of performance into your next design project.

Hand it to CHANDLER-EVANS . . .

for Development

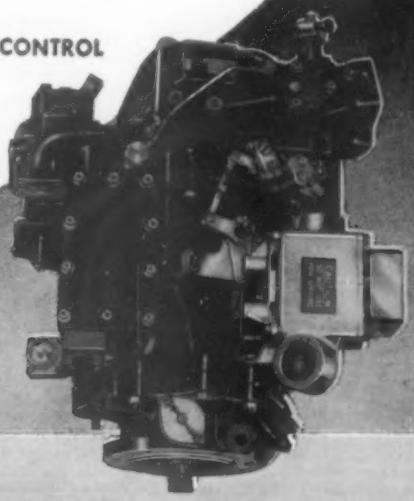
DUAL FUEL PUMP

ONLY CECO MANUFACTURES COMPLETE FUEL PUMPING AND CONTROL SYSTEMS . . .

. . . Pumps, Main Controls, Afterburner Controls, and Accessories . . . all engineered to work together as a perfectly coordinated team!

CECO's fully integrated facilities are available to carry your project through from concept to finished product. Included are: CREATIVE ENGINEERING — with the talent, knowledge and experience to develop newer, finer designs; MANUFACTURING — with the ability to produce components with the extreme accuracy essential to high performance levels; TESTING — more-than-adequate facilities for fact-finding research and rigid final inspection. These are some of the reasons why . . . wherever progress in the air demands finer, more advanced fuel pumps and controls . . . you'll find a better answer when you hand your problems to Chandler-Evans.

MAIN CONTROL



AFTERBURNER CONTROL

CECO

CHANDLER-EVANS

WEST HARTFORD 1, CONN., U.S.A.

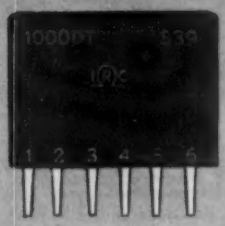
PIONEER PRODUCERS OF

JET ENGINE FUEL CONTROLS • AFTERBURNER CONTROLS • PUMPS • SERVOMECHANISMS • CARBURETORS • PROTEK PLUGS

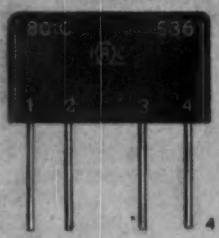
NOW

molded printed electronic circuits

Improved circuit plate assemblies are available from IRC. Combining unsurpassed experience in producing film type composition resistors and precision molding skills, IRC again aids the advance of electronics. Type MCR Printed Electronic Circuits are fully protected by an exclusive *molded* enclosure. The entire assembly is a sturdy, compact, wafer-thin unit—ideal for automation.

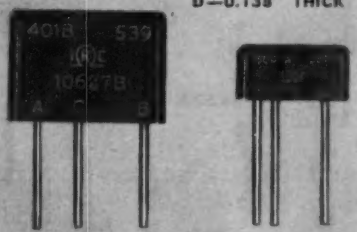


Designed for Automation



WIRE LEAD
OR TAB LEAD
TERMINATIONS

4 UNIFORM SIZES
A, B, & C—0.127" THICK
D—0.138" THICK



Packaged for Automation

SEND COUPON FOR
IRC DATA BULLETIN

Type MCR features

- greater moisture resistance
- less load-life change
- uniform terminal spacing
- unaffected by vibration
- competitively priced
- better temperature coefficient
- no possibility of "shorting"
- easier handling

Typical applications

- vertical integrators
- coupling circuits
- diode filter circuits
- triode coupling circuits
- interstage connectors of audio amplifiers

Insulated Composition Resistors • Controls & Potentiometers • Boron and Deposited Carbon Precistors • Power Resistors • Precision Wire Wounds • Ultra HF and High Voltage Resistors

Wherever the Circuit Says

Hermetic Sealing Terminals • Low Wattage Wire Wounds • Selenium Rectifiers • Strips and Discs • Voltmeter Multipliers • Molded Printed Circuits • Chokes

IRC

INTERNATIONAL RESISTANCE CO.
Dept. 153, 401 N. Broad St., Philadelphia 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee

Send Bulletin describing MOLDED Printed Circuits:

Name_____

Company_____

Address_____

City_____ State_____

High-Temperature Receiving Tube Introduced by General Electric

By Philip J. Klass

General Electric last week announced the development of a tiny (about the size of a transistor) ceramic-titanium receiving tube capable of withstanding the extremely high temperatures and shock found in supersonic aircraft and missiles.

Although the first tube-type available, the 6BY4, is aimed at the television-receiver market, GE officials plan to develop a full line of micro-miniature ceramic tube types for avionic and military electronic applications. Some of these units could be available in 12 to 18 months, a company spokesman told AVIATION WEEK.

The unit is a high-mu, low-noise triode capable of operating up to 900 mc. Samples have been operated successfully at 500C for more than 500 hr. Subjected to standard noise and microphonic tests, the 6BY4 has failed to yield any measurable microphonic output, GE says.

However, it is the 6BY4's high-gain, low-noise, high frequency characteristics which makes it attractive for use in UHF television tuners, GE says. The new tube is expected to cost TV manufacturers around two dollars, a company spokesman says.

Stacked Construction

In external appearance, the new GE tube resembles the stacked ceramic receiving tube developed by Eitel-McCullough (AW Aug. 22, p. 61). The GE version is considerably smaller than the Eimac tube since it must operate at higher frequencies and has a lower power rating.

The 6BY4 measures only $\frac{7}{16}$ in. in diameter and $\frac{3}{8}$ in. long; the Eimac twin-triode measures about $\frac{3}{4}$ in. in diameter and $\frac{3}{4}$ in. long. However, future low-frequency, higher-power versions of the GE tube may be somewhat larger than the 6BY4.

The tube is built up from three ceramic spacers which support and insulate two titanium "washers" and a titanium end-cap which functions as the tube's anode (see photo, p. 72). The titanium washers serve as a means of support and external electrical connection to the tube's electrodes.

GE is secretive about the processes, developed by its research lab, which are used to weld the ceramic and titanium and to evacuate the tube. However, a spokesman says that the seals remain airtight at temperatures above 700C.

Titanium finds its first use in vacuum tubes for two very important reasons:

• **Easily de-gassed.** GE discovered that titanium, unlike many other metals, need only be heated to 700C for a short period to release all internal gas.

Thereafter, increases or decreases in temperatures produce no further gassing. This is important because gas sealed into a vacuum tube, or released after sealing, causes deterioration of the cathode oxide coating, shortening tube life.

• **Excellent "gettering" properties.** Titanium eliminates the need for conventional "getters" because it absorbs gases within the tube.

Characteristic Advantages

Many of the 6BY4's advantages over its glass-envelope predecessors stem directly from its microminiature size and novel construction. For example:

• **Reduced inductance** at very high frequencies stems from the short, direct connection to internal electrodes made possible by the titanium washers. This eliminates the long leads running from electrodes to base pins employed in conventional tubes.

• **Reduced coupling** between cathode and plate results from effective shielding provided by the grid and its titanium support.

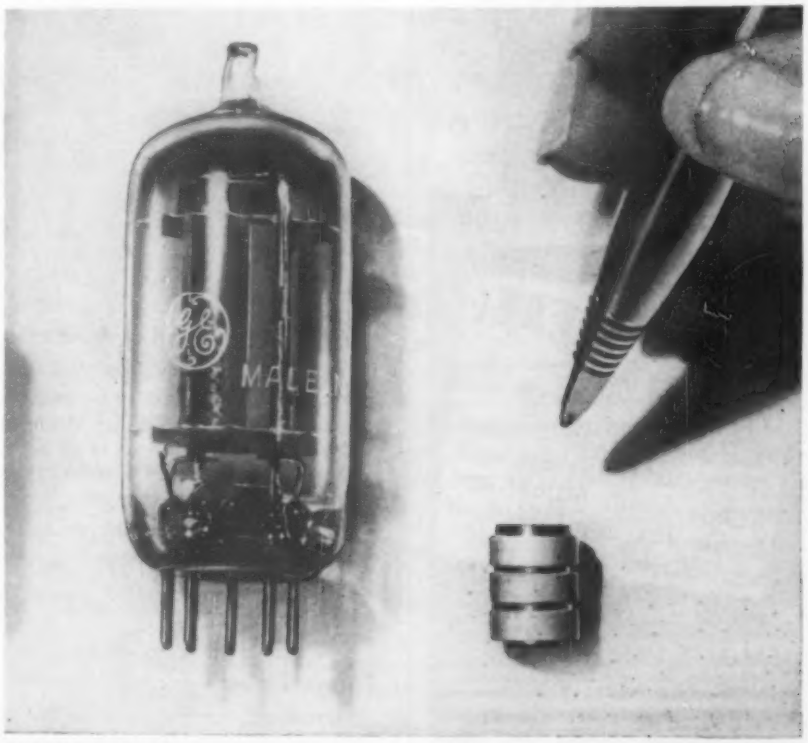
• **Reduced inter-electrode capacitance** results from the use of extremely small electrodes.

• **Rapid electron transit time** results from the extremely close electrode spacing. For example, when the tube is operating, spacing between grid and cathode is only 0.0006 in. However, a GE spokesman says, this spacing may have to be increased for tubes designed

Far From Dead

"Since the revolutionary development of the transistor, there has been a tendency in some quarters to assume that the vacuum tube is a dead duck. Other thoughtful persons have expressed concern that research and development on vacuum tubes might become neglected in favor of semi-conductor research.

"But the remarkable achievement of miniature ceramic vacuum tubes, with their exceptional capabilities at microwave frequencies—and their phenomenal high-temperature tolerance—which the transistor can not even approach, shows that the vacuum tube art is far from dead."—Dr. C. G. Suits, vice president and director of research, General Electric.



CERAMIC RECEIVING TUBE (at right) is dwarfed by conventional miniature tube (left).

DARNELL CASTERS & WHEELS

GIVE LONG YEARS OF PEAK PERFORMANCE

Here's Why

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

RUST-PROOFED . . . by zinc plating, Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

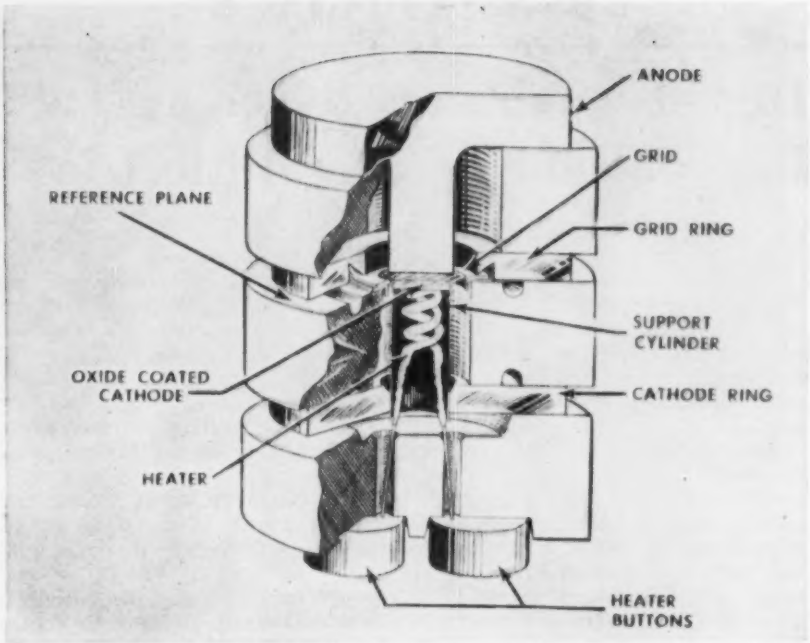
STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Zerk fittings are provided for quick grease-gun lubrication.

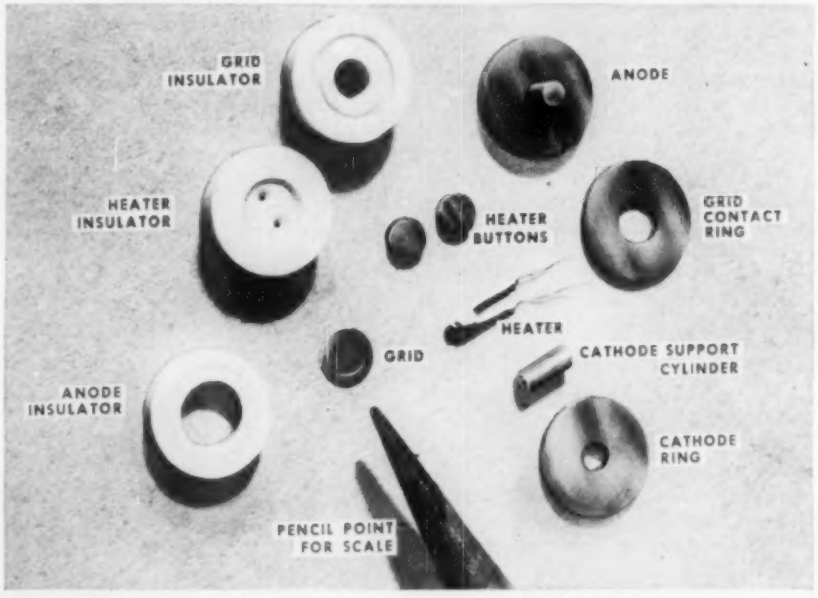
ASK FOR FREE MANUAL...

describing over 4000 types of Darnell Casters and Wheels—with fittings and treads for every kind of application.

DARNELL CORPORATION, LTD.
DOWNEY (LOS ANGELES COUNTY) CALIFORNIA
60 WALKER STREET, NEW YORK 13, NEW YORK
36 NORTH CLINTON STREET, CHICAGO 6, ILLINOIS



INTERNAL CONSTRUCTION DETAILS of GE micro-miniature ceramic tube, type 6BY4. ●



SMALL SIZE of elements in the 6BY4 is emphasized when placed alongside pencil point.

to operate under vibration and shock encountered in aircraft and missiles.

GE has released following figures on performance characteristics of its 6BY4, measured at 900 mc., in a grounded-grid circuit, with 10 mc. bandwidth:

- **Power gain:** 15 db.
- **Noise factor:** 8 db.
- **Amplification factor:** 100
- **Transconductance:** 6,000 micromhos
- **Plate voltage:** 200 v.
- **Filament:** 6.3 v.

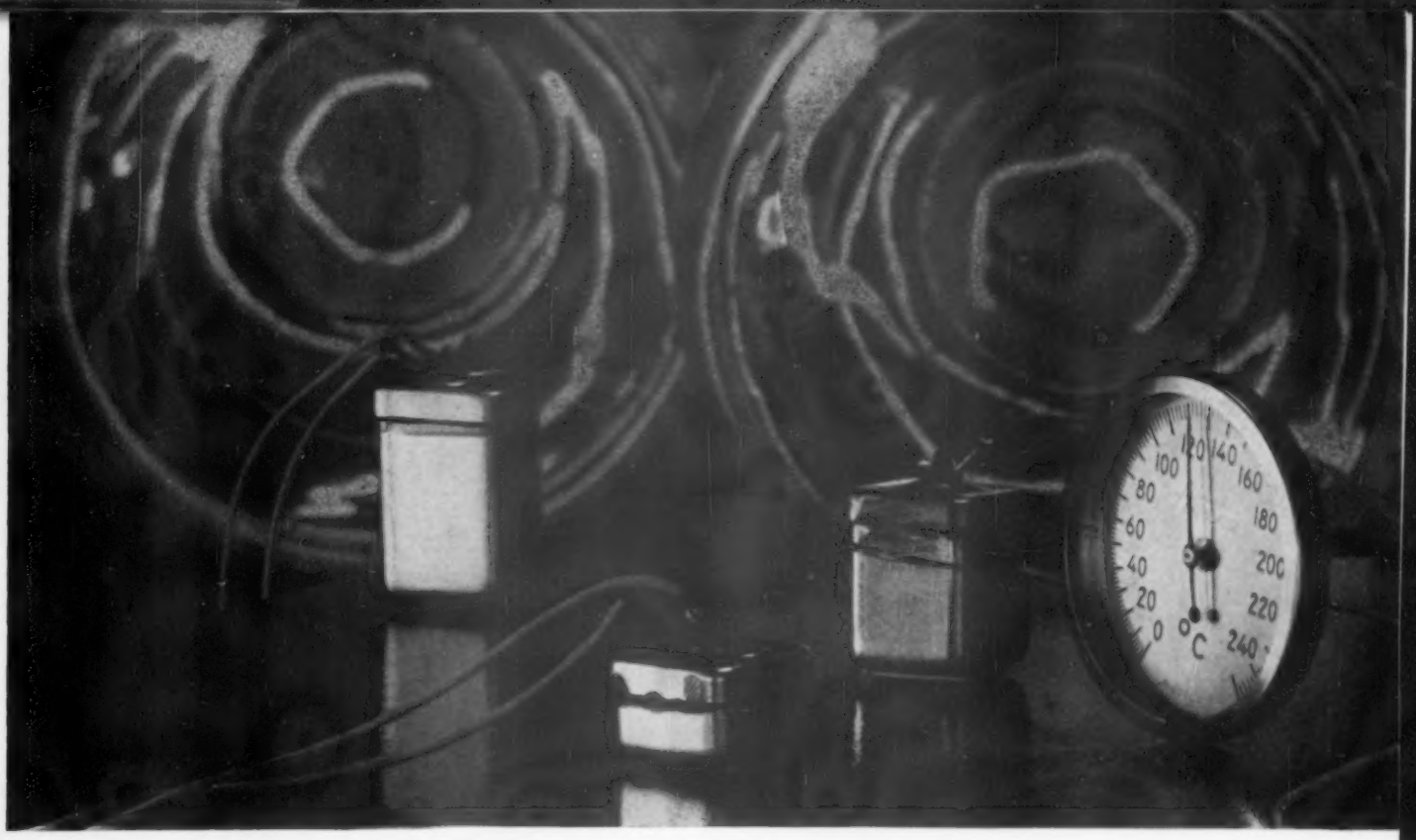
Future Plans

GE officials say future plans for avionic and military microminiature ceramic tubes includes low- and high-mu types, as well as power amplifiers, in both triode and multi-element types.

Another project on the GE agenda is to develop mechanized assembly techniques and machines for fabricating its ceramic tubes, which at present must be assembled under microscopes.

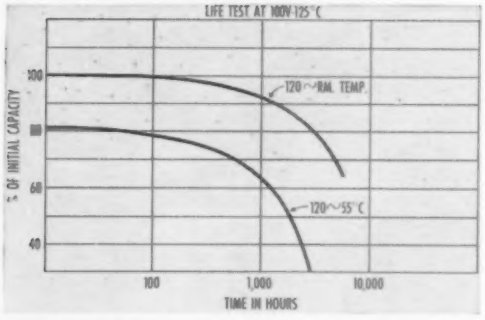
Both from the standpoint of size and internal construction, the GE ceramic tube appears less easily adapted than the Eimac and Sylvania ceramic tubes to mechanized assembly.

However, from the standpoint of mechanized placement of the completed tube in printed circuit boards, the GE tube appears to have a very slight advantage over its two competitors.

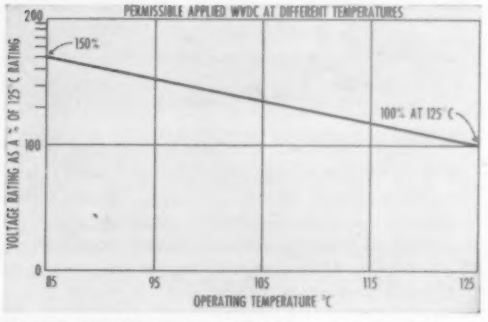


INFRA-RED LAMPS RAISE AMBIENT TEMPERATURE TO +125 C.

NEW G-E TANTALYTIC* CAPACITORS OPERATE AT +125°C AMBIENT



LONG LIFE of G-E high temperature Tantalytic capacitors is shown by this graph of life vs loss of capacitance for typical 100 volt d-c unit.



HIGHER VOLTAGES than 100 VDC can be applied . . . with no loss of life . . . at ambient temperatures below rated +125 C as shown above.

Available in ratings from 36 uf at 100 VDC to 180 uf at 30 VDC

Designed to operate at +125 C for 1000 hours with not more than 20% loss in initial +25 C capacitance, General Electric's new high-temperature Tantalytic capacitors meet the tough requirements of miniaturized military equipment.

FOIL CONSTRUCTION assures the same long life, high quality, and stable operating characteristics provided by +85 C Tantalytics. Unlike other types of Tantalytic capacitors, the foil construction also offers:

- **Both polar and nonpolar construction.**
- **Chemically neutral electrolyte . . . minimizes corrosion danger.**
- **Excellent mechanical stability . . . freedom from electrical noise under shock and vibration.**
- **Excellent reliability at rated temperatures . . . extended life at temperatures below +125 C.**

AVAILABILITY: G-E high-temperature Tantalytic capacitors can be obtained now in sample quantities for evaluation and prototype use. Production lots will be available by September in the following standard ratings:

Voltage	uf Case 1 ¾" x ¾" x 1 ⅛"	uf Case 2 ¾" x ¾" x ⅞"	uf Case 3 ¾" x ¾" x ½"
30	180	110	55
50	100	60	30
75	60	36	18
100	36	24	12

For more information, see your G-E Apparatus Sales Representative or write for Bulletin GEA-6258, General Electric Company, Section 442-27, Schenectady 5, New York.

*Reg. trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

VITAL TECHNICAL INFORMATION ON ENGINE PERFORMANCE is gathered by G-E tech reps at military bases in 26 countries. Their regular reports, sent back to G.E., include operating record of each engine, servicing problems encountered, recommendations for improving reliability and performance.

A new G-E record—J47 engines on F-86F's are now accumulating . . .

33,000 hours per in-flight shut-down

Another record for reliability has been set by General Electric J47 jet engines.

From January, 1953–December, 1954, *all* J47's powering North American F-86F's amassed a total of 33,000 flight hours for *each* incident requiring engine shut-down. Indicative of G-E powerplant dependability, this mark was set despite casualties in Korean action.

In the same two-year period, the J47 enabled Boeing B-47 Stratojets to run up a cumulative 24,000 engine operating hours per shut-down. During this time, B-47's logged a total of over 1,700,000 hours in the air.

Compared to commercial and military piston engine operations, this new record shows that the J47 averages about twice as many engine flight hours per shut-down. Such reliability, plus simple design, points the way to more and more applications for G-E jet engines.

5,500,000 MILES A DAY—Each day at USAF bases around the world, G-E J47's are flying over 5,500,000 miles, or the equivalent schedule of an airline with 340 four-engine transports.

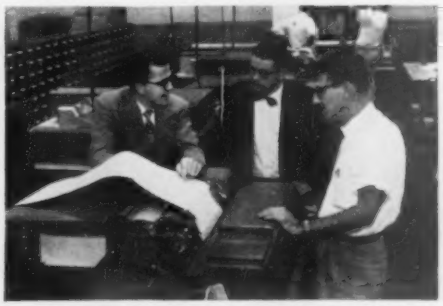
Analyzing, recording and applying this unmatched operating experience (see below), General Electric has been able to deliver steadily better production engines to our Armed Forces and—most important—faster development of new powerplants.

Looking ahead, for example, G.E. is now testing an engine designed for supersonic speeds. And even more advanced powerplants, both jet and atomic, are in early development stages—another reason why, at General Electric, "Progress is our most important product." 232-13

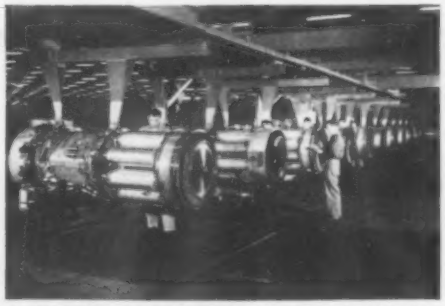
Progress Is Our Most Important Product

GENERAL ELECTRIC

WHY J47 OPERATING RECORDS MEAN BETTER G-E JET PERFORMANCE



BATTERY OF IBM MACHINES CONSOLIDATES FIELD REPORTS which are then analyzed by G-E statisticians. Complete information on each part of all operational engines enables G-E engineers to improve existing powerplants, as well as recommend long-range design advances.



DESIGN IMPROVEMENTS ARE QUICKLY APPLIED TO HARDWARE at G-E engine plants. Over 20,000 such improvements have been made in the J47, raising allowable time before overhaul to 1200 hours on some models. Field service analysis has been a major factor in achieving this record.

INCREASED AIRCRAFT AVAILABILITY, reduced maintenance time and costs are important benefits of G-E engine analysis. Top Air Force operational engine, the J47 will have logged over 9,000,000 flight hours by December, 1955.

TO ALL EXECUTIVE AND PR

We know how much you respect the ex

the best flight equipment. Here are the facts . . . s

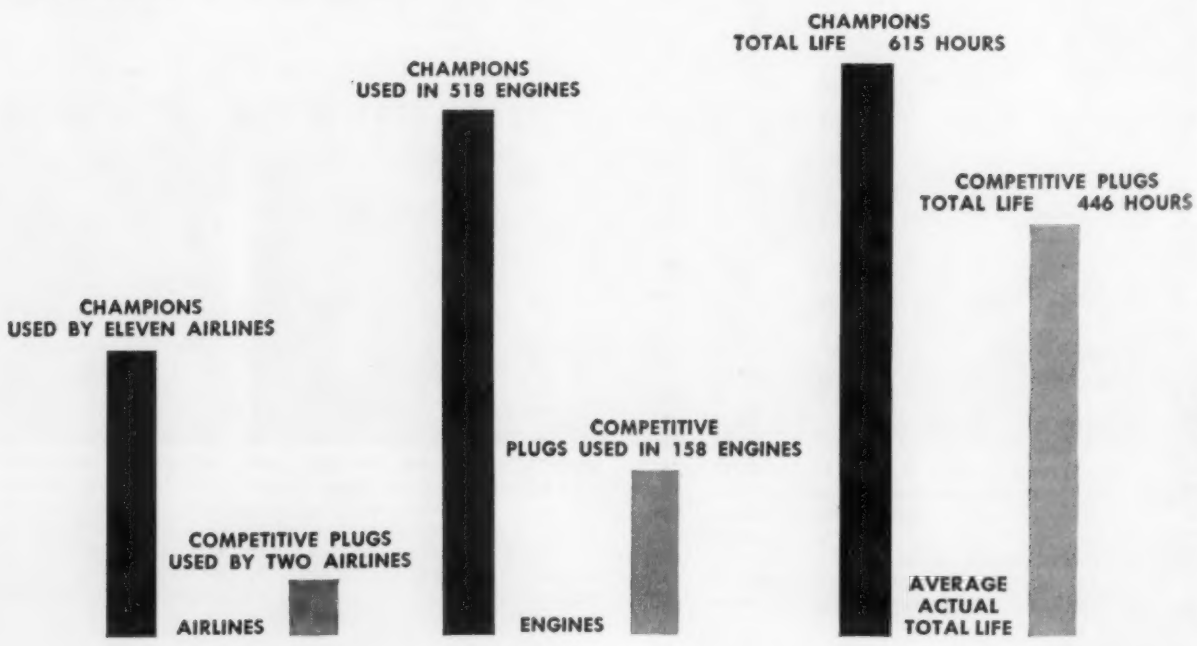
September 1, 1955, on their choice of spark p

engines and other reci

TURBO-COMPOUND ENGINES

Airline	Type	No. Aircraft	Spark Plugs	Engines Using Only Champion	Engines Using Other Plugs
AMERICAN	DC-7	27	Champion	108	....
DELTA C&S	DC-7	10	Champion	40	....
EASTERN	DC-7	9	Other	....	36
	L1049C	16	Other	3*	61
NATIONAL	DC-7	4	Champion	14	2*
NORTHWEST	L1049G	4	Champion	16	....
PAN-AMERICAN (Atlantic Div.)	DC-7	9	Champion	26	10*
TRANS-WORLD	L1049G	20	Champion	80	....
UNITED	DC-7	25	Champion	100	....
KLM	L1049C	12	Other	2*	46
AIR FRANCE	L1049C-G	18	Champion	69	3*
TRANS-CANADA	L1049C	7	Champion	28	....
SEABOARD & WESTERN	L1049D	4	Champion	16	....
LUFTHANSA	L1049C	4	Champion	16	....

*Evaluation Test



RIVATE AIRCRAFT OWNERS:

experience of the major airlines in selecting
supplied by the airlines themselves as of
plugs both for the demanding turbo-compound
ciprocating engines.

AIRLINES USING CHAMPIONS IN OTHER PISTON ENGINES

AEROVIAS REFORMA, S.A. • TRANS-TEXAS AIRWAYS • LOIDE AEREO NACIONAL S/A • REAL S/A-TRANSPORTES AEREOS

VIACAO AEREA SAO PAULO, S/A • SOUTHWEST AIRWAYS • UNITED AIR LINES • WESTERN AIR LINES • TRANSP. AEREOS DE YAJALON, S.A.

SERV. AEREOS DE CHIAPAS, S.A. • LINEAS AEREAS UNIDAS, S.A. • AEROVIAS VENEZOLANAS, S.A. • AEROVIAS NACIONALES DE COLOMBIA

ALLEGHENY AIRLINES • AMERICAN AIRLINES • BRANIFF INTERNATIONAL AIRWAYS, INC. • CALIFORNIA CENTRAL AIRLINES • CAPITAL AIRLINES

CENTRAL AIRLINES • MARITIME CENTRAL AIRWAYS • ISRAEL AIRLINES, LTD. • SERVICOS AEREOS CRUZEIRO DO SUL, LTDA. • CONTINENTAL AIR LINES

COLONIAL AIRLINES • DELTA-C & S AIR LINES, INC. • EASTERN AIR LINES • FLYING TIGER LINE • FRONTIER AIRLINES

CAT INCORPORATED • NATIONAL AIRLINES • NORTH CENTRAL AIRLINES • NORTHEAST AIRLINES • NORTHWEST AIRLINES, INC. • PACIFIC NORTHERN AIRLINES

SOUTH AFRICAN AIRWAYS • AIR FRANCE • SABENA • PAN AMERICAN WORLD AIRWAYS, INC. • AEROLINEE ITALIANE INTERNAZIONALI (ALITALIA)

SOCIETE DES TRANSPORTS AERIENS DE L'EXTREME ORIENT (COSARA) • EMPRESA DE TRANSPORTES AEROVIAS BRASIL • PHILIPPINE AIRLINES

ORIENT AIRWAYS LTD. • AIR CEYLON LIMITED • AIR-INDIA, LTD. • CANADIAN PACIFIC AIRLINES, LTD. • QANTAS EMPIRE AIRWAYS, LTD.

COMPAGNIE AIR ALGERIE • AERONAVES DE MEXICO, S.A. • IRANIAN AIRWAYS • FLUGFELAG ISLANDS, H.F. (ICELAND AIRWAYS LTD.) • AIR TAHITI

CARIBBEAN-ATLANTIC AIRLINES, INC. • TRANSPORTES AEREOS NACIONAL LTDA • COMPANIA CUBANA DE AVIACION, S.A. • GARUDA INDONESIAN AIRWAYS N.V.

UNION AEROMARITIME DE TRANSPORT • AIR-INDIA INTERNATIONAL, LTD. • SCANDINAVIAN AIRLINES SYSTEM • NATIONAL GREEK AIRLINES

LLOYD AEREO BOLIVIANO S.A. • THAI AIRWAYS CO., LTD. • PANAIR DO BRASIL, S.A. • DECCAN AIRWAYS LTD. • BHARAT AIRWAYS LTD.

WEST COAST AIRLINES • AIRWAYS (INDIA) LTD. • TURKISH STATE AIRLINES • TRANS-CANADA AIRLINES • OZARK AIRLINES • AEROVIAS GUEST, S.A.

TRANS-WORLD AIRLINES, INC. • COMPANHIA ITAU DE TRANSPORTES AEREOS • LINEE AEREE ITALIANE S.P.A. • KLM ROYAL DUTCH AIRLINES

LINEA AEROPOSTAL VENEZOLANA • CENTRAL AFRICAN AIRWAYS CORP. • TRANS-AUSTRALIA AIRLINES • COMPANIA DE AVIACION "FAUCETT" S.A.

AERO O/Y CIA. MEXICANA DE AVIACION, S.A. • BRITISH COMMONWEALTH PACIFIC AIRLINES, LTD.

IBERIA PAN AMERICAN-GRACE AIRWAYS, INC. • PIEDMONT AIRLINES • CATHAY PACIFIC AIRWAYS, LTD.

VARIG ETHIOPIAN AIRLINES, INC. • AEROLINEAS ARGENTINAS • HAWAIIAN AIRLINES LIMITED

AER LINGUS • SLICK AIRWAYS • TRANSPORTES AEREOS MEXICANOS, S.A.

JAPAN AIR LINES • PIONEER AIR LINES • SOUTHERN AIRWAYS • SWISSAIR

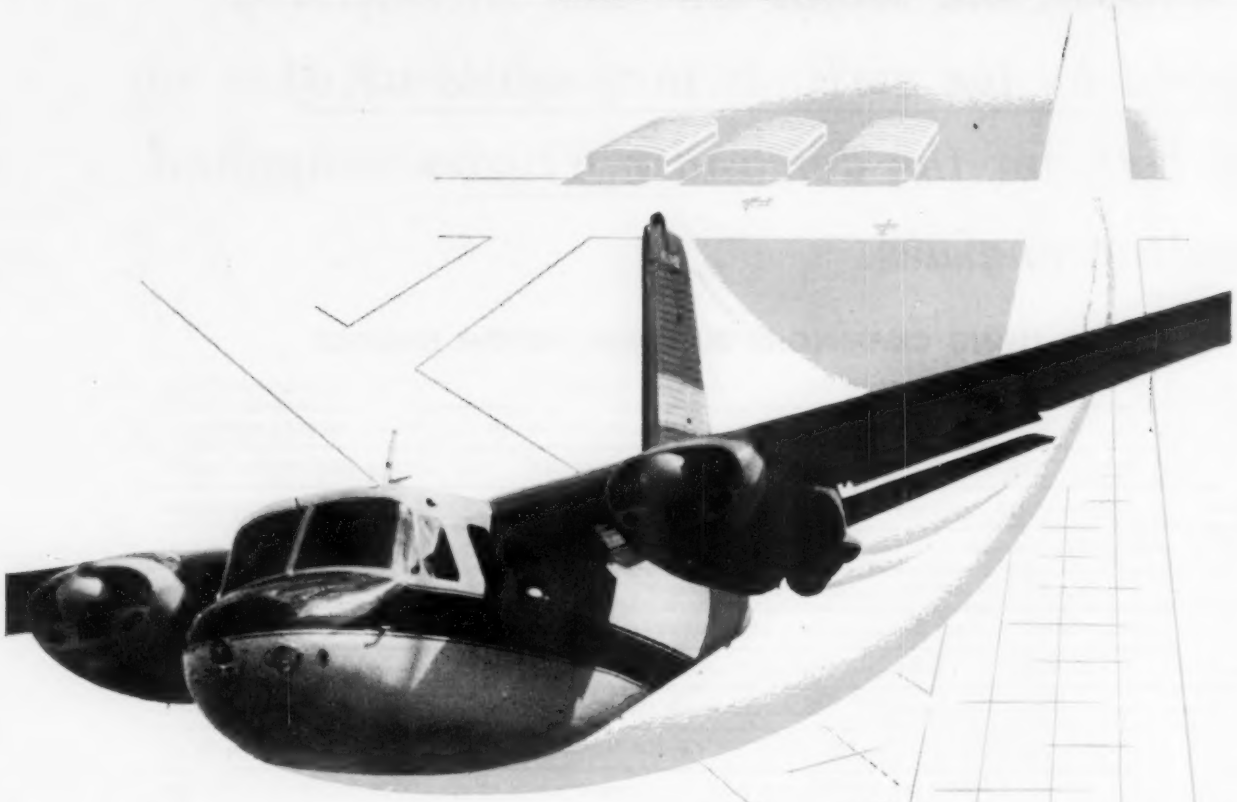
HOLLINGER UNGAVA TRANSPORT • AIR SERVICES OF INDIA, LTD.

MOHAWK AIRLINES • BRAATHENS SOUTH-AMERICAN & FAR EAST AIRTRANSPORT

You Want The Same Safety And Performance The Airlines Demand . . . Make Sure You Get It! Specify

Champion Spark Plugs!

now *Supercharged* performance



MORE SPEED—230 m.p.h. @ 70% power (260 m.p.h. maximum). **MORE RANGE**—1400 miles normal range (1600 miles maximum). **MORE LOAD**—7,000 lbs. gross (2750 lbs. usable). These are but three of the outstanding features in the new supercharged

AERO Commander -680- Super

For complete information see your nearest Aero Commander distributor or write for Catalog 128-S

AERO DESIGN & ENGINEERING CO • TULAKES AIRPORT • P.O. BOX 118 • BETHANY, OKLAHOMA

New Avionic Equipment Proposed As Aids for Air-Traffic Control

Washington—Confronted by the certainty of even greater airspace congestion, delegates to the Radio Technical Commission for Aeronautics here, proposed and examined new avionic equipment and techniques for safely controlling the increasing numbers of new and faster aircraft. Among the various proposals:

- **Development of new light plane** VHF receivers incorporating a wider range of channels to speed up tower-to-plane communication.
- **Modification of flow-control** procedures to give planes with the greatest number of communication channels priority.
- **Continued expansion** of the Civil Aeronautics Authority's "peripheral," or remote, VHF facilities enabling air route traffic controllers to talk directly with aircraft several hundred miles away.
- **Development** of an air traffic control signaling system (ATCSS) capable of transmitting instructions, weather maps, etc., to individual aircraft.
- **ATC transponder beacons** to improve the potential of ground radar as an air-traffic-control device.
- **Installation of autopilot** approach couplers that automatically fly an airplane down the ILS localizer and glide slope beams (United Air Lines already has a number of these installed in their planes).
- **Formation of an air traffic control** advistory team to assist Air Navigation Development Board engineers on a continuing basis.

(The proposal for the establishment of an air traffic control advisory team was made by Sam P. Saint, veteran airline pilot and consultant to the Air Navigation Development Board. For detailed account of his views on the problem of traffic control—and the equally-strong ones of Lt. Gen. Joseph Smith, commander of the Military Air Transport Service—see AVIATION WEEK Oct. 10, p. 15.)

Frank C. White, a member of the Air Transport Association's air navigation and traffic control group, called for the development of new communications' equipment for light planes.

Pointing out that the airlines are fast equipping their fleets with new VHF receivers with 50 kc. channel spacing to double or quadruple the number of channels available, White told RTCA that the lightplane operator who wants to fly into congested terminal areas under instrument (IFR) conditions must be able to increase the number of available channels in his radio equipment.

Most of today's lightplane radio transmitters have only six to eight communications channels as compared with the 360 channel sets the airlines are now buying, White said.

A lightplane entering a congested terminal area must communicate successively with approach control, local control and, sometimes, precision radar control operations. At each shift, the lightplane operator must re-tune his VHF non-crystal controlled receiver manually, frequently asking the tower for a "voice count" to be sure it is properly tuned. The result is increased delays in the entire system, White said.

Industry Challenge

White challenged the avionics industry to develop a low-cost $300-400), light-weight private flyer VHF set, crystal-controlled, capable of operating at each and every 100 kc. channel between 118.1 and 126.7 mc. Recognizing that this would probably require the use of crystal-saving circuitry, now employed in the more expensive airline-type equipment, White said that an acceptable alternative would be a 20-channel set whose channels could be changed easily to any required frequency merely by plugging in new crystals.

He also proposed a modification of the present flow-control, used under adverse IFR conditions, in which aircraft may be prohibited from entering or leaving a congested terminal area until the traffic control system "catches up." White suggested that flow control might first be exercised on the basis of an individual aircraft's communications capability i.e. a plane with more communications channels would be given priority over one with only a few channels.

This, White believes, would not only ease congestion of over-crowded radio channels, but would provide incentive to lightplane operators to increase their radio capabilities.

Max Karant, of the Aircraft Owners & Pilots Assn., replied that it should be possible to expand communications capabilities of private aircraft to meet their operational needs, but he cautioned against mandatory increases in channels for all private operators. Karant pointed out that private flyers have bought nearly 35,000 VHF sets from two major manufacturers and that these should not be obsoleted arbitrarily.

John H. Hilton told the RTCA that the increasing use by the CAA of long

Tacan Status Report

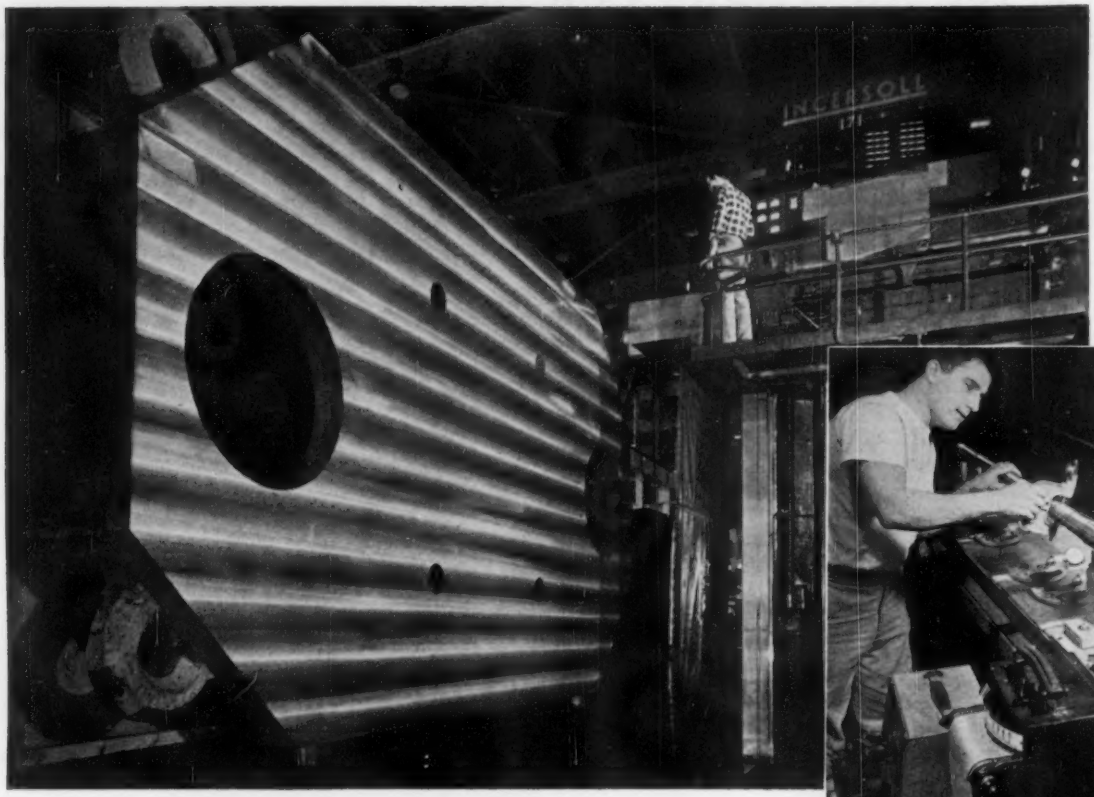
Two major investigations which may determine whether Tacan becomes the nation's Common System navigation aid are scheduled to be completed within 60 days, according to Col. J. F. Taylor, Jr., director of the Air Navigation Development Board. In his status report to the RTCA, Taylor said:

- Determination of the number of interference-free Tacan channels, under way at Airborne Instruments Laboratory should be completed by Nov. 1.
- Airspace coverage nav-aid requirements to provide airways-type service from sea level to 75,000 feet and area type service from 18,000 to 75,000 ft. is complete. Studies of area-type service down to the earth's surface is under way. These results have not been made public pending completion of the number of available interference free channels.
- Channel requirements for Tacan to enable it to provide the desired airways and area type service is under study by the National Bureau of Standards and should also be ready by Nov. 1. In making the determination, NBS must establish what Tacan performance may be expected in the 1965-70 period, including the performance from low-power Tacan stations with ranges of 30 and 100 miles. Characteristics and performance measurements which can be used to predict this performance, for both airline and private type equipments, are being obtained by AIL and NBS engineers.

Taylor reported that the Joint Chiefs of Staff has furnished ANDB with a statement which, in effect, reaffirms the military requirement for Tacan to meet the needs of the continental air defense system.

The CAA's Technical Development Center is redesigning the military Tacan ground station equipment (URN-13) to make it suitable for common system use, including such things as provision for dual equipment with automatic switchover in event of failure, Taylor reported.

He said he believes that the omnirange and DME functions of Tacan should be made available to civil users on a separate-function basis, and that a lightweight, low-cost Tacan receiver should be developed. (Federal Telecommunications Labs has demonstrated such a unit.) However, Taylor cautioned that the increased bearing accuracy available from Tacan should not be seriously comprised in such low-cost models.



Mass and precision: *At left,* a large horizontal boring mill at Bliss' Canton plant is used to finish machine 200-ton weldment for 25,000 ton press. *Directly above,* an electronic recording gage checks three separate tapers in the chambers of barrels for 20 mm machine guns. Tolerances are held to 0.002".

Before you decide who's going to build it...

You're wise to get a bid from BLISS

The reasons are quickly summed up: flexible manufacturing facilities backed by long experience and a record of successful performance on past contracts, both government and civilian. Whether you want a few hundred-ton units or many thousands of small parts weighing a few pounds each, be sure to check with Bliss before you buy.

BLISS offers you... the experience gained in the production of equipment like

• aircraft carrier catapults • 20 mm machine guns • gun mounts • ammunition machinery • torpedoes • shells • tank cupolas

plus facilities that include • 11 U.S. plants—two million square feet of floor space and, at present day values, about a $44,000,000-inventory of metalworking tools • Four foundries pouring steel, iron and Meehanite castings, including the largest and heaviest types • Two welding departments with equipment to cut out, weld, preheat and anneal weldments weighing hundreds of tons.

BLISS
SINCE 1857

E. W. BLISS COMPANY, General Offices: Canton, Ohio

CATAPULTS • ARRESTING GEAR • MACHINE GUNS
NAVAL GUN MOUNTS • SPECIAL MACHINERY

is more than a name... it's a guarantee

Plants at: Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pennsylvania; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France.

range radar for traffic control makes such direct communications even more important.

Present CAA plans call for the installation of 64 additional peripheral VHF (and UHF) stations by 1960. Another 46 "high-site" installations are planned to give maximum possible line-of-sight range.

Each individual VHF frequency, Hilton said, will be paired with a discrete UHF frequency (used by the military services).

This will enable pilots to hear all communications between ground controllers and other aircraft in the area, both civil and military.

"Private Line"

Vernon Weihe reported that an air traffic control signaling system (ATCSS), capable of transmitting routine instructions, weather maps or a snapshot view of a ground radar scope to individual aircraft, relieving overloaded voice channels, is now in the embryo stage. The information will be displayed in the cockpit on a bright storage-type cathode ray tube, such as those developed by Hughes, Radio Corporation of America, Farnsworth and Raytheon.

The Melpar ATCSS system can operate with conventional VHF equipment, through the addition of suitable adaptors, Weihe said. Information transmitted from the ground is suitably "addressed" to the individual aircraft for which it is intended and is not displayed in the cockpits of other aircraft.

Weihe indicated that the airplane's ATCSS adaptor could be set up to transmit back to the ground information on the plane's bearing, distance and altitude when suitably interrogated.

The Melpar ATCSS system requires a bandwidth of 800 to 3,000 cps., depending upon the quality of picture required in the cockpit for presentation of maps and similar information.

Although Weihe did not indicate how far off the operational use of ATCSS might be, Frank White estimated that the "private line" is "at least five to seven years away—even if we could reach agreement today on what the system should be."

Radar Beacon Progress & Problems

Although all civil and military agencies agree in principle that ATC transponder beacons hold considerable promise of improving the usefulness of ground radar for air traffic control, certain problems must first be solved before the new aid can get into widespread use, S. B. Poritzky, of Aeronautical Radio Inc., told the group.

Poritzky read a CAA statement which reported that "significant unresolved problems (will) . . . control the actual dates of implementation." The CAA's Technical Development Evaluation Center currently is attempting to work out some of the problems. If they are successful, three trial installations on ASR radars in the New York area should be in operation by September 1956, with ASR installations to follow at Chicago and Washington.

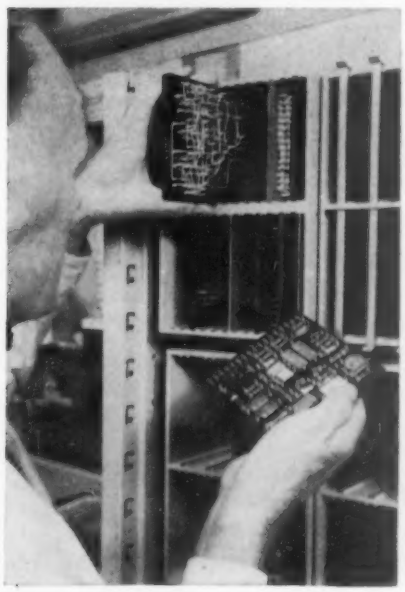
Trial beacon installations on long range traffic control radars at N. Y. International, Washington, and Norfolk are also planned.

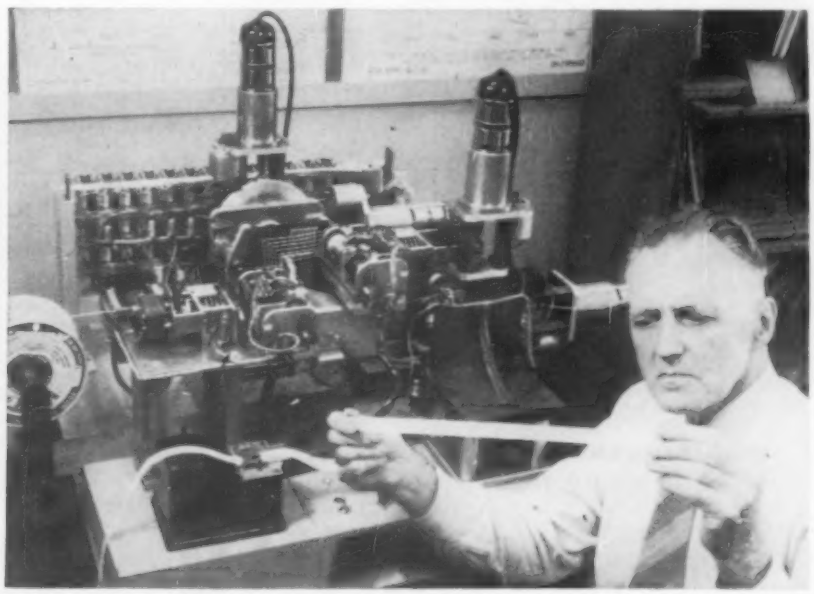
Moving Cautiously

If the CAA appears to be moving cautiously, some of the beacon system problems which Poritzky discussed show why. For example, in congested terminal areas, airborne transponders will be interrogated by several ground radars, which may overload the transponders, effectively incapacitating them. For the same reason, replies to the interrogation of one ground radar will be received by all others in the area and will appear on the latter's scopes as interference pulses.

Another problem stems from the fact that the beacon system operates at 1,030 and 1,090 mc., right in the middle of the band assigned to Tacan. This may lead to Beacon-Tacan interference unless Tacan vacates these two, and possibly adjoining channels.

A report on the results RTCA's Special Committee 18 studies and United Air Lines operational experience with autopilot approach couplers suggests that more airliners and business aircraft will be equipped with these aids in the near future. The joint report came from E. A. Post, superintendent of nav-aids





Bell Wire-Wrap Process

A new approach to the automation of electronic equipment developed by Bell Telephone Laboratories makes use of BTL-developed solderless wire-wrap process of attaching wires to terminals. Patchwork of conventional wiring (above, left) is automatically installed by "M-4" ambidextrous machine (right) operating under instructions from punched tape. Machine uses two rotating spindles—one pulls wire from reel to a connecting terminal; the other automatically cuts wire to desired length. Each spindle then removes insulation from wire ends as it whip-wraps the bare wire around board terminal. Afterwards, spindles pick up new wire supply and make next connection. The BTL approach to automation was first revealed by Aviation Week (Mar. 8, 1954, p. 44).

ON TODAY'S PLANS... IN TOMORROW'S SKIES
SHAFER
AIRCRAFT BEARINGS
ConCaVex Design
...10° plus or minus self-alignment always available
...Easy relubrication without disassembly
...High radial and full thrust load capacity
...Exceptional shock-load reserve strength
LEADING BEARING DESIGN FOR MORE THAN 35 YEARS
SHAFER BEARING
DIVISION OF CHAIN BELT COMPANY
Send for Catalog #54 showing complete line of Shafer Single-row, Double-row and Rod-end Bearings. Write to Shafer Bearing Division, Chain Belt Company, 801 Burlington Avenue, Downers Grove, Illinois.

for UAL and head of RTCA's SC-18.

Post reported that UAL has equipped nearly all its aircraft, except DC-3s, with autopilots and approach couplers. For nearly a year United has been using the combination (at a number of selected airports with good approaches and high intensity approach and runway lights) down to minimums of 200 ft., ½-mile visibility, whereas manual approaches are permitted only to 300 ft., ¾ mile minimums.

On the strength of UAL's experience, Post said he saw no reason why auto-approach minimums "should not be lowered in steps to at least 100 ft., ¼ mile, or the equivalent slant range visibility, as bugs are worked out of the aircraft systems and SC-18's recommendations are implemented."

The SC-18 report, when it is released, will recommend certain permissible sensitivities, linearities and alignments for localizer and glide slope beams, as well as the use of improved automatic monitors to continuously check these characteristics. A large number of the CAA localizer and glide slope beams already fall within the prescribed tolerance, Post said.

CAA's Edgar B. Franklin, chief of EHA Air Carrier Safety Division, indicated that his agency already has taken steps to ease previous low-altitude limitations on the use of autopilots and approach couplers, consistent with what it deems to be safe practices. New CAA proposals for flight testing autopilots and approach couplers under simulated malfunction conditions have been submitted to the ATA and Air Line Pilots Association, as well as other industry groups, for comment.

FILTER CENTER

► **Bearing-Only Tacan**—Federal Telephone & Radio may produce a private-flyer Tacan receiver providing bearing information only, comparable to service provided by VOR receivers (see p. 79). The device is expected to sell for under $1,000. The DME portion of the receiver could be purchased and added later. Private flyer versions of the full Tacan receiver, providing both bearing and distance, will be marketed first and will become available for purchase early next spring, an FTR spokesman says.

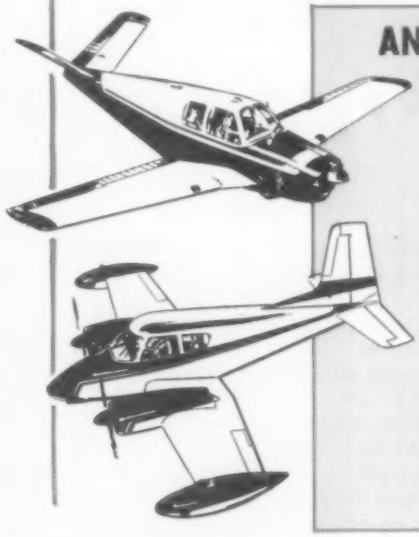
► **Praise For Lear VGI**—Navy evaluation of the 3-inch Lear remote vertical gyro indicator (VGI) calls the unit the "finest small attitude gyro ever evaluated in jets at the Naval Air Test Center." The report praises the unit's readability and recommends its use on all future Navy fighter and attack air-

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD ®

You're Ahead All Ways

with CONTINENTAL AIRCRAFT POWER

. . . IN ECONOMY
. . . IN RELIABILITY
. . . IN MAINTENANCE EASE
. . . IN WORLD-WIDE SERVICE



AND REMEMBER:

Continental's Engine Remanufacturing Service gives you a new factory-remanufactured engine—back to zero hours and with factory new engine guarantee—at a low fixed cost, with virtually no dead time. . . . Ask your Continental Motors service station about this Continental-pioneered program which boosts the utility of aircraft—stimulates their wider use.

PARTNERS IN MAKING PRIVATE FLYING THE SAFEST MEANS OF TRAVEL

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

craft. USAF's Eglin AF Base reportedly

Avionic Bulletins

TONS OF POWER

AT HIS FINGERTIPS!

...And Sargent precision aircraft controls make that power instantly available at the touch of a finger.

The design and manufacture of precision equipment has been the specialty of Sargent Engineering Corporation for more than 35 years. For 20 years Sargent has been providing precision aircraft control units—hydraulic, pneumatic, and mechanical—for the country's leading airframe manufacturers.

We have the "know-how" to help you solve your most difficult control problems. *Write today for your copy of the NEW illustrated story of Sargent's organization, methods, and manufacturing facilities.*

Standard of Excellence — Sargent — *Since 1920*

ENGINEERING CORPORATION
2533 EAST 56TH STREET
HUNTINGTON PARK, CALIF.

"Good will" is the disposition of the pleased customer to return to the place where he has been well treated.
— U.S. Supreme Court

craft. USAF's Eglin AF Base reportedly has recommended the Lear VGI's use in all fighters

▶ **Emerson Eyes Interceptor Field**—Emerson Electric, which has concentrated its fire control activities in the bomber defense field, is eyeing the interceptor fire control field. The move is a hedge against the possibility that supersonic bombers of the future may not carry active defense such as tail turrets.

▶ **Transistor Standardization**—New diffused-base technique for making transistors holds promise of enabling silicon transistors to cover the bulk of circuit requirements, including both high power and high frequency, Dr. J. A. Morton, Bell Telephone Labs, told the recent Western Electronics Convention. Morton reported that diffused-base silicon transistors have been developed which can deliver 5 watts power at 5 mc. Morton estimated that pilot production of diffused-base transistors is at least a year away.

Avionic Bulletins

● **Tape resistors** and their application to miniaturization are discussed in four-page Bulletin HEC-1, available from Hansen Electronics Co., 7117 Santa Monica Blvd., Los Angeles 46, Calif.

● **A 400-cycle Vernistat,** a device which reportedly combines the best features of an a.c. potentiometer and a variable autotransformer, is described in four-page bulletin which includes design principles and spec. Perkin-Elmer Corp., Norwalk, Conn.

● **High-temperature capacitors** employing "XC" plastic film dielectric, for operation at temperatures of —65C to 165C, are described and engineering specs are given in six-page folder, XC-201-4. Gudeman Co., 340 West Huron St., Chicago 10, Ill.

● **Electronic punched-card sorter,** capable of handling alphabetic, numeric, blank, and special code punched cards at the rate of 48,000 per hour, is described in 6-page folder, TM-156, available from local Remington Rand sales offices or by writing Remington Rand Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

● **"Methods of Potting Cannon Plugs"** is the title of new 12-page bulletin which shows step-by-step method employed to pot and seal connectors against moisture. Ask for Bulletin PM-1. Cannon Electric Co., 422 W. Avenue 33, Los Angeles 31, Calif.

● **Magnetic servo amplifiers** and output stages, in several types, are described and application data given in 8-page folder. Feedback Controls, Inc., 1332 No. Henry St., Alexandria, Va.

A Painter's Friend

An H-19 helicopter came to the rescue recently when a Bendix Aviation Corp. radar servicing crew needed to paint the almost-inaccessible top of a radome at Thule AFB in Greenland. After other proposed routes were found wanting, the helicopter from the 55th Air Rescue Squadron lowered the painters onto the fabric-covered radome (above) and then whisked them away again once the job was completed.

PAN AMERICAN

USES FAMOUS

WAKMANN

AIRCRAFT CLOCKS

. . . respected and selected the world over for true watchmaker craftsmanship and time-tested reliability.

A-10-A (MODIFIED)
ELAPSED-TIME AIRCRAFT CLOCK
USAF specification MIL-C-9196; AND 10400, with center chronographic sweep second and hour register hands. Matte white markings on black background. Lightweight oxidized aluminum case. Also in 12-hour dial.

FREE catalog — Fine Aircraft Clocks
Write: Dept. A0
WAKMANN WATCH CO., INC.
15 West 47th St., N. Y., N. Y. Judson 6-1750

Qualified suppliers to Army, Navy, Air Force

(Advertisement)

Aero Supply Mfg. Co. Inc. of Corry, Pa., announces a series of general engineering data bulletins of a non-advertising nature prepared by Aero Supply's Research and Development Center recently established in Cleveland, Ohio. The bulletins consist mainly of technical data with charts, graphs and other valuable information related to the design of aircraft, rocket and missile fuel systems.

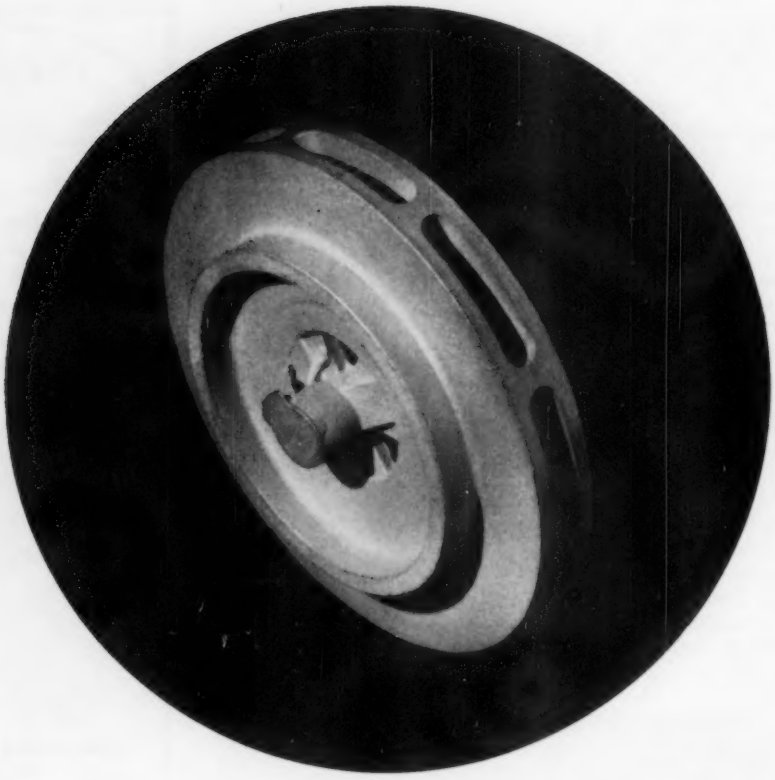
The first four bulletins show viscosity vs temperature data for approximately 120 different fluids and have been available since September 6, 1955. The fifth and sixth bulletins will be published in Mid-October, 1955 and show viscosity vs temperature data for aviation fuels.

For over 39 years Aero Supply Mfg. Co. Inc. has been a leading designer and manufacturer of fuel system components, cockpit controls and related articles for all flight applications. Qualified representatives and engineers are readily available upon request to offer assistance on specific engineering and application problems.

Address Request to

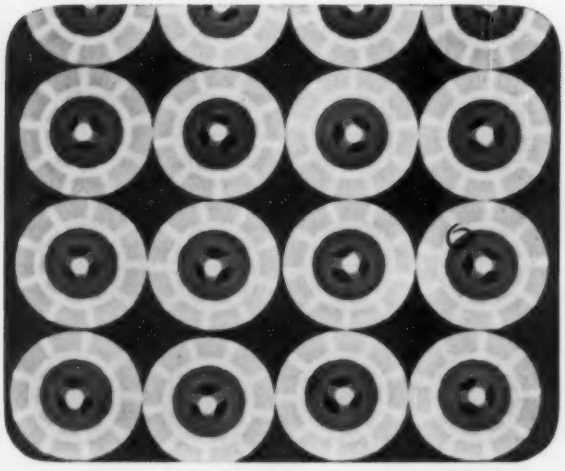
Aero Supply Mfg. Co. Inc.,

Research and Development Center,
P. O. Box 402, Corry, Pa.



SPINS LIKE "BLAZES"—

so Radiography checks each one



Radiograph of oil scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shorter expression for the rate at which this rotor spins. Fact is, rpms are so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography...

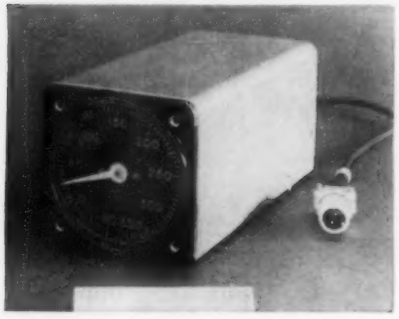
another important example of Photography at Work

Kodak
TRADE-MARK

NEW AVIONIC PRODUCTS

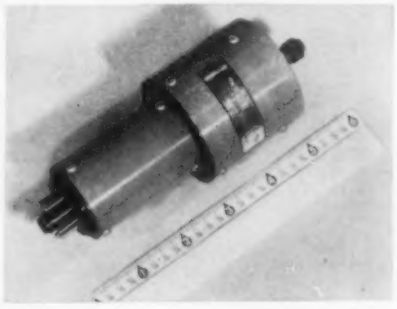
Instrumentation

● Self-balancing potentiometer, Model EMP-NS2, completely self-contained, can be used to indicate temperatures during flight, operating from ther-



mocouple signals, or to indicate acceleration, operating from strain gages. Complete unit, including amplifier and indicator, weighs 3 lb. **North American Aviation, Inc., Missile and Control Equipment Dept., Downey, Calif.**

● Pressure-to-frequency transducer, Series P400, available in absolute, differential or guage types, for FM/FM telemetering unit. Unit converts pressure measurement into a temperature-controlled varying inductance which in turn varies the frequency of an FM oscillator built into the same case.



Transducer can be supplied for any standard sub-carrier frequency, between 1.7 kcps and 70 kcps, with deviations of 7½% or 15%. Model P512 (not shown) is designed for measuring transient pressures. It also contains a built-in FM oscillator. **Datran Engineering Corp. 3613 Aviation Blvd., Manhattan Beach, Calif.**

● Rotary sampling switch, Model AE-00007, for use with the AN/AKT-10 FM/FM telemetering system, consists of two poles of 60 contacts each rated at a sampling speed of 5 rps. Unit is driven by a 28 v.d.c. motor with governor. Other models are available in other sampling speeds of 1 to 30 rps,

Photo courtesy
Herman Nelson Division, American Filter Co., Inc.

THIS HEAT EXCHANGER *of stainless steel for the Herman Nelson Portable Air Heater, "Aviation's cold weather friend", is another precision fabricated assembly made by Lavelle for military aircraft application. At Air Force bases everywhere, the BT-400 Heater provides a ready source of heat for pre-heating engines, cockpits, and for countless maintenance jobs . . . wherever reliable space heat is required to help keep America's defense planes airborne.*

Heat Exchanger Stainless Steel 16" dia. x 18"

Extensive fabricating facilities, plus Government Certified welding technicians has enabled Lavelle to produce over 6,000 of these complex assemblies, each requiring 16 separate airfoil section heat exchanger tubes. To assure close tolerances and speed production of the many component parts of the unit, special tools were designed and made at the Lavelle plant. Complete inspection includes pressure testing of each unit prior to shipment to Herman Nelson. Simple or complex, Lavelle has the capacity to fabricate the precision parts and assemblies you need . . . wherever you need them.

A new brochure describes Lavelle's specialized fabricating services. Write for a copy without obligation.

Lavelle

LAVELLE AIRCRAFT CORPORATION • NEWTOWN, BUCKS COUNTY, PA.

Saving This Man's Time

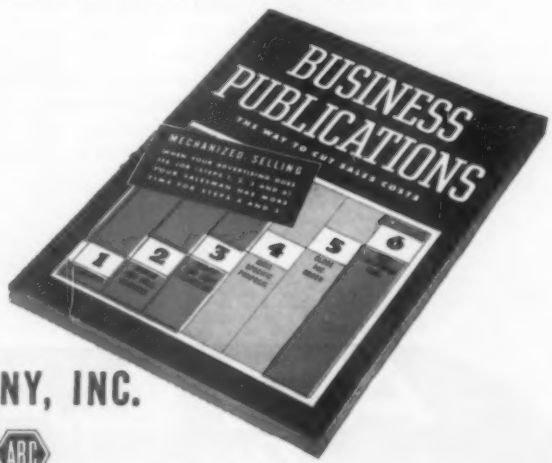
Saves Sales Dollars

There just aren't enough hours in a day for a salesman to do an adequate selling job without help. In addition to time spent on office work and awaiting interviews, the growth and decentralization of industry has brought problems of increased travel time, more buying influences and more difficult access to plant personnel.

When you advertise your product or service, consistently, in business publications your prospects look to for help with their jobs, you multiply the calling power and increase the productivity of your sales staff. Business paper advertising can talk to thousands of prospects . . . can arouse interest in, and create a preference for, your product . . . at pennies per call.

Just as high speed machines cut production costs, well-planned business publication advertising cuts sales costs. It "mechanizes" the first three steps of a sale and lets the salesman concentrate his valuable time and talent on the all-important job of making the proposal and closing the sale.

Ask your McGraw-Hill man for a copy of our 20-page booklet, "Orders and How They Grow." Also about our new sound-slide film, "Plateau of Progress" which is available for showing at sales and management meetings.

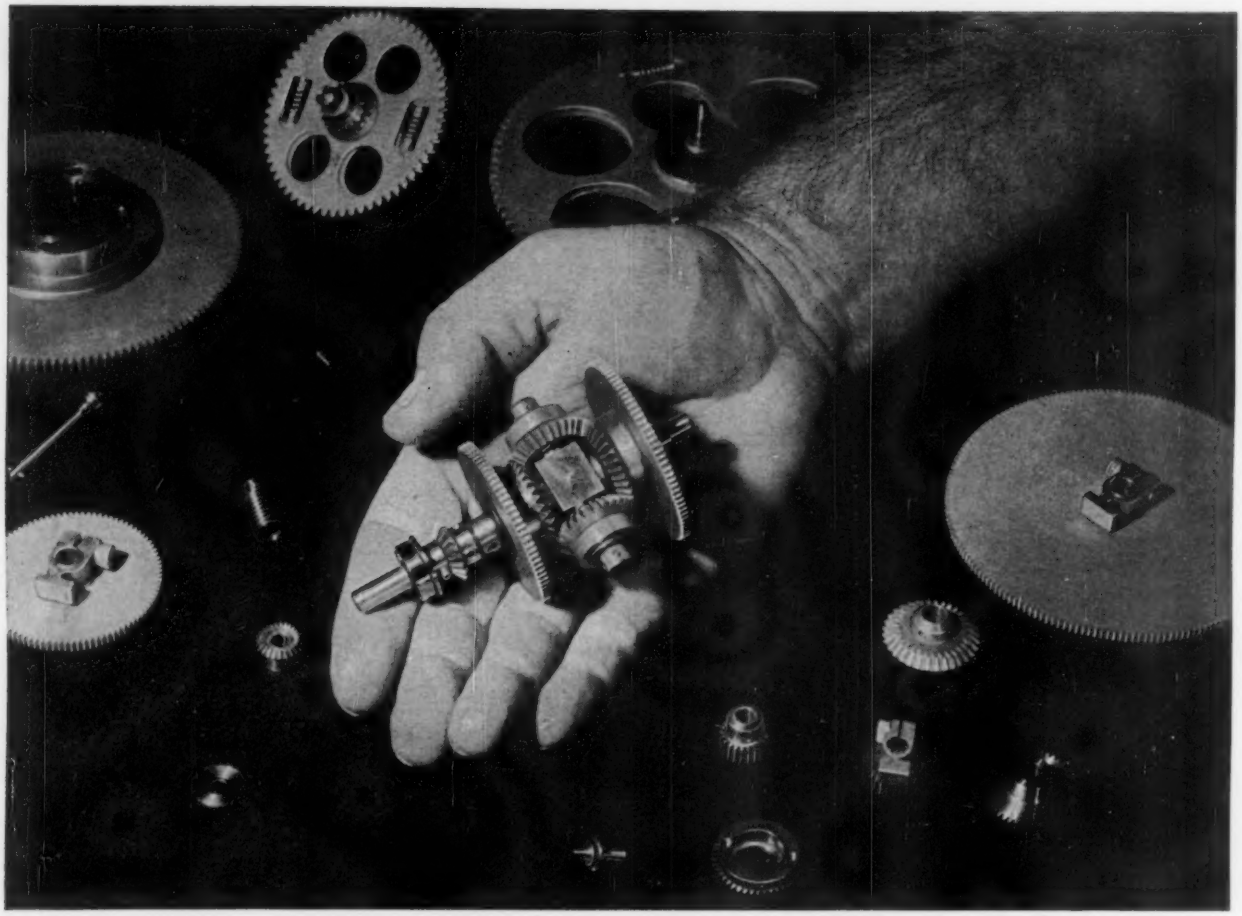


McGRAW-HILL FOR BUSINESS

McGRAW-HILL PUBLISHING COMPANY, INC.

ABP 330 WEST 42nd STREET, NEW YORK 36, N. Y. ABC

HEADQUARTERS FOR BUSINESS INFORMATION



Geared To The "Go"

OF THE MOST PRECISE EQUIPMENT

Spur, bevel, spiral, hypoid, zerol, helical, worm gears . . . anti-backlash gears . . . differentials . . . gear trains . . . complete computers, Atlas "precisioneers" them all to the most exacting specifications of electro-mechanical equipment.

Fine gears of all types and the modern equipment to make them are just one phase of the complete facilities of Atlas. Whether your product is a specialized part for electronic equipment or a complete electro-mechanical assembly Atlas will engineer precision assemblies and components to your requirements.

Atlas design, production and methods engineers, toolmakers and skilled mechanics work right along with you on a job basis. Every modern cost-cutting tool and technique is at your service . . . plus quality control, functional testing and modern electronic recording gear checking equipment.

From idea stage to production efficiency Atlas "creative engineering" can help you get your product *underway* quicker and at lower costs. Write today for booklet "Precisioneering Electro Mechanical Equipment." Atlas Precision Products Co., Philadelphia 24, Pa., (Division of Prudential Industries).

"From Drawing Board . . . to Production Line"

SERVICE ATLAS DEPENDABILITY QUALITY

ATLAS

Precision Products

with a choice of drive motor, number of contacts, poles, and percent duty cycle. **Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.**

Components & Devices

● Lightweight servo motors, in size 11, 15 and 18, for operation at temperatures of 125C or higher, are now available in reduced-weight versions. Typical weight reduction in the size 18 is 3 oz. **G-M Laboratories, Inc., 4300 No. Knox Ave., Chicago 41, Ill.**

● Miniature high-speed valve solenoid, reportedly requires only 5 milliseconds to reach saturation at any altitude. Unit operates over temperature range of −65F to 200F, and can be internally pressurized at 3,000 psig. **Carruthers & Fernandez, Inc., 1501 Colorado, Santa Monica, Calif.**

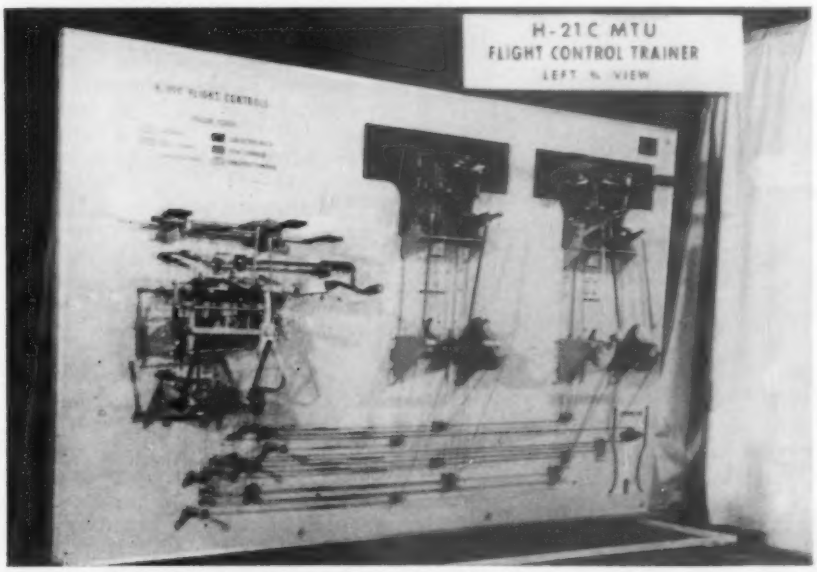
● Silicon rectifiers, available for operation at 50, 100, 150 and 200 volts, have forward current rating of 8 amps with natural convection cooling at 25C, up to 40 amps with forced cooling. **Westinghouse Semiconductor Dept., 356 Collins Ave., Pittsburgh 6, Pa.**

● Auxiliary power supply, miniature, encapsulated, with no vacuum tubes, operates from 115 v., 60 or 400 cycle line and provides two unregulated d.c. outputs: 150 v., at 6 ma., and 6.3 v.a.c. (center-tapped), at 0.6 amps. Ripple is kept below 1 millivolt at 400 cps., below 5 mv., at 60 cps. Unit measures $2\frac{3}{8}$ x $3\frac{1}{16}$ x $4\frac{1}{4}$ in. **Trio Laboratories, Inc., 3293 Seaford Ave., Wantagh, L. I., N. Y.**

● Capacitor induction motors, for 60 and 400 cps. use, are available in $\frac{1}{10}$ to 1/100 hp. sizes for operation at all standard voltages—single, double or three-phase. Units measure $3\frac{7}{8}$ in. dia. for continuous duty, $3\frac{1}{8}$ in. for fan or intermittent duty. Maximum motor weight is less than 5 lb. **Eastern Air Devices, Inc., 389 Central Ave., Dover, N. H.**

● High-temperature sub-miniature trimpot, Model 160, can be operated at temperatures of −65F to 350F, with power rating of 0.6 watt at 100F, and 0.4 watt at 200F. Resolution as low as 0.25% can be obtained over 25-turn adjustment range. Resistances of 10 to 10,000 ohms in standard values are available. Unit measures $\frac{1}{4}$ x $\frac{3}{8}$ x $1\frac{1}{4}$ in. **Bourns Laboratories, 6135 Magnolia Ave., Riverside, Calif.**

● Miniature annunciator, Model HCM $\frac{3}{4}$, a D'Arsonval type indicator for use as a null-indicator in autopilots and servo systems or as a flag alarm, measures $\frac{3}{4}$ in. dia. x $1\frac{3}{8}$ in. long and weighs 1.3 oz. Device is hermetically sealed and is available in typical instrument ranges. Annunciator is said to meet vibration requirements of MIL-E-5272A, Procedure I. **Marion Electrical Instrument Co., Manchester, N. H.**



Panel Trainer for Work Horse Copter

This panel demonstrating operation of the Piasecki H-21C Work Horse flight controls is one of a set developed for the Army. Other panels show the electrical system, hydraulic system, transmission and special tools required for H-21C maintenance. The mobile maintenance trainer was built by Burton-Rodgers of Cincinnati before its recent merger with Technical Training Aids, Inc., Tulsa. Sets have been delivered to the Army Transportation School, Ft. Eustis, Va., and Camp Rucker, Ala.

Here's prop-to-tail AIRCRAFT MAINTENANCE know-how

You get the specialized aeronautics knowledge you need—a wealth of valuable material — in the Northrop Library. It tells you how to inspect, maintain, overhaul, repair, and operate all types of airplanes — from light two-seaters to seventy-passenger air liners, from wooden training planes to sleek metal jets.

You are shown how to maintain airframes and engines, both conventional and jet, with detailed directions, drawings, and photographs that make each step easily and quickly understood.

THE NORTHROP AIRCRAFT AND POWER PLANT MECHANICS LIBRARY

By the Technical Development Staff of
NORTHROP AERONAUTICAL INSTITUTE
Charles Edward Chapel • Ralph D. Bent • James L. McKinley
3 Volumes, 1276 pages, over 2000 illus., $19.95

Packed into these three big volumes are scores of job helps—trouble-shooting charts, handy check-lists, and easy-reference tables—for immediate, on-the-spot use. Working procedures and job breakdowns are explained in simple, clear language. You'll find every step of the way made plain.

Full coverage of electrical systems—You get specific data on aircraft electrical systems—wiring, instruments, batteries, generators. The Library makes plain electrical theory and practice—tells you how they work in simple words.

- How plants and their engines are constructed—how to maintain, inspect, and repair them
- Trouble-shooting charts . . . job breakdowns . . . work procedures . . . over 2000 clear pictures
- Easy to read . . . simple to follow . . . laid out for fast on-the-job reference

Filled with job helps—It's impossible to give you more than a sampling of the huge range of topics covered in the Northrop library. You get a host of practical methods—how to prepare fabric covering, how to do aircraft wire and cable work, how to make riveting repairs, how to gear gas turbines to propellers, how to weld, how to do sheet metal work—and all the other details the man with an A & E Rating needs to know.

These three large volumes are carefully arranged and simply written for easy reading and understanding. Beginners and skilled technicians alike can profit from this practical Library. You'll find it packed with pertinent facts and methods that keep planes in best operating condition.

EASY TERMS
Pay $3.95 in 10 days, and $4 a month for 4 months!

SEE LIBRARY 10 DAYS FREE

McGraw-Hill Book Co., att: H. W. Buhrow, Industrial & Business Book Dept., 327 West 41st St., New York 36, N. Y.

Send me for ten days' examination the **Northrop Aircraft and Power Plant Mechanics Library.** If satisfactory I will send you $3.95 in 10 days and $4.00 monthly until the price of $19.95 is paid. If not wanted I will return books postpaid.

(PRINT)
Name .....
Address .....
City .....Zone.....State.....
Company .....
Position .....

For prices and terms outside U. S., write McGraw-Hill Int'l, NYC 36 AW10-16

MISSILE TEST EQUIPMENT For over ten years Farnsworth has participated in the design, development, and production of guidance and control systems and special test equipment for such missile programs as Terrier, Talos, Sparrow, and others. Numerous "firsts" in this field have been accomplished as a result of contributions in the form of missile receivers, control systems, power supplies and complete system analyses.

INDUSTRIAL TELEVISION Standard model 600A is the result of Farnsworth's more than 30 years experience in the design and production of complex military and industrial equipment—engineered especially for industrial, educational and business use.

IMAGE CONVERTER TUBES Used in any application where it is necessary or desirable to "see in the dark." Convert an infrared image into a visible image. Applications: medical and biological research, hot-body observation, temperature distribution, crime detection, security, and photography.

INFRARED VIEWER This unique, compact, easy to handle viewer is a valuable tool for crime detection, research and industrial application. Observation of objects or scenes in the dark is easily accomplished when they are illuminated by infrared radiation.

PHOTOMULTIPLIER TUBES Responsive in the near infrared spectrum featuring sensitivities as high as 50 amperes per lumen of incident radiation. Applications include photometric measurements for industrial and scientific uses.

IMAGE DISSECTOR A highly versatile TV camera tube particularly well adapted for use as a slide or facsimile scanner. This tube can be constructed in a variety of types to meet special requirements.

RADAR RANGE CALIBRATOR, AN/UPM-11A A precision instrument incorporating both "Radar" and "Beacon" functions. The equipment operates as a radar transponder in that pulsed r-f energy fed into the equipment results in a series of return echo pulses being fed back from the equipment to the radar under calibration. This simulates radar targets at accurately determined ranges.

PORTABLE CABLE TESTER Designed for testing all radio frequency cables that will accommodate, or can be adapted to, type "HN", "N", or "BNC" connectors. It will supply a d-c voltage up to 12,000 volts provided the current drain is negligible, and current surges of at least 3,000 amperes peak into a load of 0.05 ohm at room temperature.

Farnsworth

DIVISION OF IT&T

vision . . . beyond the range of sight . . .

This is the Farnsworth

iatron

the tube with

SUN-LIKE BRILLIANCE AND MEMORY, TOO!

BRILLIANCE! Display brilliance up to 10,000 foot-lamberts. Ideal for projection purposes.

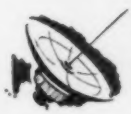
MEMORY! Image storage and presentation of several minutes duration. Operator-controllable.

RESOLUTION! Excellent detail. 300 TV lines.

Write Dept. F-21 for complete details.

RESEARCH

Applied Physics, Circuit Research, Solid State Physics, Low Temperature Physics.



RADAR

Transmitters and Receivers, Computers, Microwave Components, Pulse-Coding and Circuitry.

ELECTRON TUBES

Photomultipliers, Storage Tubes, Image Tubes, Infrared Tubes.

MISSILE

Guidance and Control Systems, Test Equipment.

Another Farnsworth achievement . . .

one of many complex electronic products developed, designed *and produced* for defense and industry . . . backed by over a quarter of a century of continuous success and leadership in the field of electronics . . . the key to amazing tomorrows.

***FARNSWORTH ELECTRONICS COMPANY** • FORT WAYNE, INDIANA*

a division of International Telephone and Telegraph Corporation

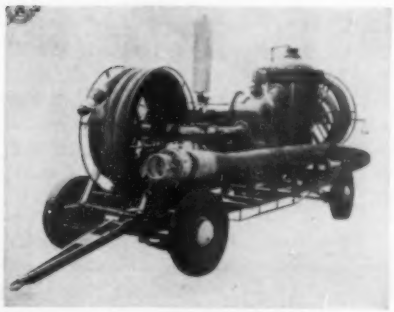
NEW AVIATION PRODUCTS

Motor Handles Pitch Trim

New 1.5-lb. brake motor designed for driving elevon pitch trim system of Douglas' supersonic F4D Skyray, has a holding torque of 2 in.-lb.

The unit is a ⅓ hp. reversible motor operating at 11,000 rpm. on the 115/200-v. system, producing a holding torque of two in. lb. The unit has been tested in accordance with MIL-M-7969.

Air Associates, Inc., Teterboro, N. J.



Refueler Tests Fuel System

Fuel-A-Plane portable fuel system tester, designed for the Lockheed Aircraft Corp., permits the operator to test the single-point fuel manifold system of either new or repaired aircraft at low pressures and flow rates. This is done without danger to the manifold or fuel tanks in case of malfunction of any component part. If the fuel system checks out, the unit is used for filling the plane's tanks.

The tester and refueler is equipped with filter, air eliminator, drippage and expansion pressure relief receptacle, fuel-flow meter and static bonding cable reel, in addition to the air starter-equipped diesel-engine-driven pump, air compressor, exhaust silencer, fuel hose reels and vacuum and pressure gages.

Harman Equipment Co., 3605 E. Olympic Blvd., Los Angeles 23, Calif.

Open-Type Aircraft Motor

Open-type aircraft motor which weighs 3.5 lb. and delivers ¼ hp. continuously at 7,200 rpm. provides a lightweight drive for blowers, pumps and actuators.

The motor functions at altitudes up to 40,000 ft. with starting torque of 4.0 in.-lb. Mounting bracket and take-off shaft are standardized in accordance with military specifications. Designated Type A, the motor is designed for three-phase, 400-cycle, 200-v. operation.

U. S. Electrical Motors Inc., Aircraft Division, Box 2058, Terminal Annex, Los Angeles 54, Calif.

Pressure Regulator Valve

Absolute pressure regulator valve for pneumatics handles flows up to 40 cfm. and maintains constant pressure at inlet temperatures as high as 550 F. The unit can be placed on any jet bleed line to air turbine power packs, compartment pressurization and cooling systems or fuel tank pressurization and relief systems.

Century Controls Corp., Allen Blvd., Farmingdale, L. L., N. Y.

Gage Measures .000001 In.

Capable of direct linear measurements to within one-millionth of an inch, the Link Fringecount micrometer utilizes the wave-length of light as basis of measurement.

The micrometer may also be employed as a precision comparator with a 2-in. range of movement from the set position.

The Link Fringecount unit consists of three separate units: a measuring head, control box and bi-directional digital counter which displays the dimension of the part being measured. The equipment can be used in measuring such items as gage blocks, plug gages, ball and roller bearings and precision instrument parts.

Link Aviation, Inc., Binghamton, N. Y.

Lear-Romec Makes New Pump

In a description of a new electric motor driven centrifugal fuel booster pump, Model RG-11280-1 (AW Sept. 26, p. 78), the manufacturer's name and address was inadvertently omitted. Manufacturer of this item: Lear, Inc., Lear-Romec Division, Elyria, Ohio.

Starter Fits Under Super Sabre

North American Aviation, Inc., is using a new jet engine starter that is built so low it can be driven underneath the F-100 Super Sabre and start its P&WA J57 engine in 14 sec. Unit can also be used as a plane tug.

Power is taken directly from a gasoline engine and transmitted to the turbojet via a hydraulic torque converter which provides a shockless power train. The unit also can provide 28-v. d.c. and 400-cycle a.c. power for aircraft.

The starter has four-wheel drive and steering and has a 160-in. turning radius. Weight is 3,500 lb. Dimensions are 30 in. high, 144 in. long and 65 in. high.

The starter was planned by NAA industrial engineer Dan Coleman and prototypes have been built by Kurtis Kraft Corp., Los Angeles, and Electric Service Engineering Co., Joliet, Ill. Five units are being used by North American's F-100 flight operations department, and the company plans to get four more for other departments.

North American Aviation, Inc., Los Angeles 45, Calif.

QUEHANNA

Pennsylvania

A new Curtiss-Wright Research and Development Center oriented to Airpower of the Future

To implement today's most advanced airpower plans . . . to stimulate and achieve the much greater power that the vistas of tomorrow require . . . Curtiss-Wright has oriented its engineering organization to embark on a new research and development program of unprecedented scale in an 85-square-mile, heavily forested area of Pennsylvania, to which the Corporation has given the name of Quehanna. The site has been part purchased, part leased for 99 years from the Commonwealth of Pennsylvania.

Here Curtiss-Wright is creating facilities which will enable power development to overtake vision . . . will expand the frontiers of air travel and space travel . . . as advanced powerplants, undreamed of yesterday, take shape in the engineering imagination, on the drawing board, and in production.

Curtiss-Wright's goal at Quehanna is to provide our armed forces with the finest in aircraft engines of every type . . . to provide our engineering forces with the *power* to transform their most advanced ideas into actuality . . . and at the same time to reduce lead-time and costs, providing America with *more* air force, *better* air force per dollar, *sooner*.

Central to air, rail and highway transportation . . . to the other Curtiss-Wright offices and plants and the whole industrial East . . . to ample power and water supplies . . . and to Pennsylvania's highly skilled manpower areas . . . Quehanna constitutes an ideal site for this significant new Curtiss-Wright facility.

CURTISS-WRIGHT

CORPORATION • WOOD RIDGE, NEW JERSEY

ENGINEERS • TECHNICIANS • SCIENTISTS

Curtiss-Wright has permanent career positions open for specialists in advanced engines and propellers, metallurgy, electronics, nucleonics, ultrasonics, plastics and chemistry. New 85 square mile Research and Development Center at Quehanna, Pennsylvania and expanded divisional engineering programs are creating opportunities for more engineers, technicians and scientists in both aviation and diversified industrial projects.

ALSO ON THE MARKET

Self-lubricated bearing material for missiles and aircraft, Sinite D-10 has proved successful in liquid oxygen and JP-4 fuel bearing problems, maker says. The material is self-lubricating from −90 to 500F.—Booker-Cooper, Inc., 6940 Farmdale Ave., N. Hollywood, Calif.

Nylon-rayon aircraft seat belt is adjustable, 2-in. type. Buckle latch has disk cut-out for flush-mounted insigna. Available in dark blue, dark green, beige, gray and tan.—Air Associates, Inc., Teterboro, N. J.

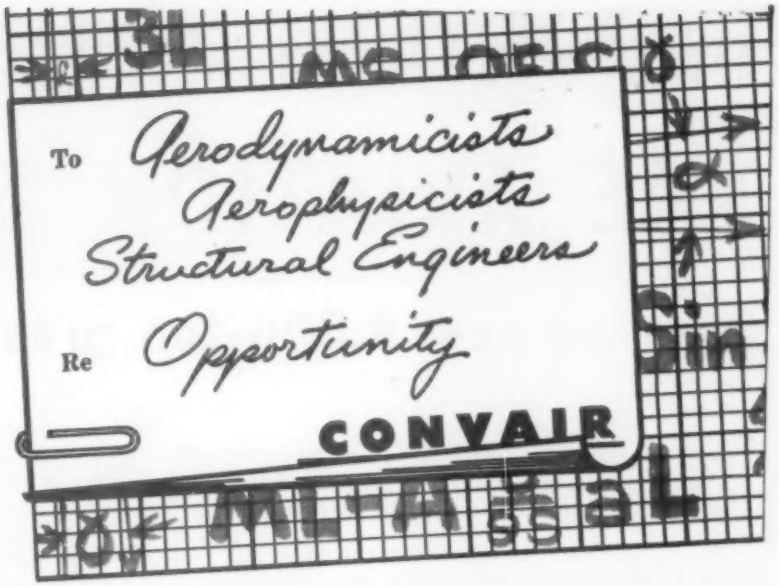
Shock-resistant plastic package for bearings can be mailed safely under all conditions and re-used indefinitely, it's claimed. Plastic vacuum-formed shell contains the bearing, set into an outer shipping sleeve of spiral-wound fiber.—Cargo Packers, Inc., Brooklyn, N. Y.

Wire twister with a diagonal grip-head and slender nose was especially designed for work in narrow, hard-to-reach places. The new model is available in 12-in. length for assembly line work and 9-in. length for bench and subassembly work.—Ralph C. Robinson Co., Box 494-P, N. Sacramento 15, Calif.

Motor induction coupling drive provides stepless, variable speeds over ranges from 2:1 to 34:1 with constant torque output. Unit features high response, maintains accurate rpm. and requires minimum maintenance. Motor sizes start at ¾ hp. at 3,400 rpm. and extend to 75 hp. at 1,700 rpm.—American Electric Motors Inc., 2112 Chico Ave., El Monte, Calif.

Temflex 105, a vinyl plastic tubing meets fungus and heat requirements of MIL-I-631B. The tubing is used by electrical equipment and electronic manufacturers and for continuous operation at temperatures to 105C.—Irvington Div., Minnesota Mining & Mfg. Co., 6 Argyle Terrace, Irvington 11, N. J.

Turret-type device for automatically loading work pieces between centers and removing the pieces when ground can be adapted to a variety of small parts that can be rolled by gravity on inclined rails, permitting the operator to attend a battery of machines . . . . Type CMS-1 semi-automatic **multi-wheelslide cylindrical grinding machine** plunge grinds multiple diameters simultaneously on workpieces that do not lend themselves to grinding on conventional multi-wheel machines . . . . 48F Hyprolap **high production lapping**



There is an important place for you at CONVAIR-FORT WORTH if you have the qualifications and desire to perform vitally essential work in these technical areas.

AERODYNAMICS

Lift and Drag Prediction of Aircraft and Missiles—
Aerodynamic Loads—Wind Tunnel Testing—
Performance of Aircraft and Missiles—
Cruise Control
Flight Test Data Analysis

AEROPHYSICS

Stability and Control of Aircraft and Missiles
Analysis of Fire Control and Electronic Countermeasure Systems
Systems Engineering—Including Navigation, Missile Guidance, Radar and Microwaves

STRUCTURAL ENGINEERING

Stress and Deflection Analyses—Materials Research and Development—Preliminary Design—
Aerodynamics of Steady and Non Steady Flow—
Flutter Model Design—Electronic Computer Programming—
Fatigue Problems

Attractive openings also exist in other technical areas.

As a division of General Dynamics Corporation, CONVAIR occupies an important place in the long-range development of the Nation's aerial defense as well as commercial aviation. CONVAIR'S activities afford inviting career opportunities for engineers, physicists and scientists — opportunities for professional accomplishment and personal income.

At CONVAIR-FORT WORTH you work in ideal, air-conditioned surroundings. A company-sponsored, in-plant program enables candidates to earn graduate degrees in Engineering. CONVAIR offers liberal travel allowance, paid vacations, excellent insurance and retirement programs.

Fort Worth in the Great Southwest has an abundance of sunshine and dry, fresh air conducive to outdoor living and recreation. Within a few minutes drive of Fort Worth are seven large lakes which provide ample facilities for fishing and other water sports.

For further details write M. L. TAYLOR
CONVAIR Engineering Personnel Dept. A
Fort Worth, Texas

CONVAIR
FORT WORTH

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
FORT WORTH, TEXAS

IMPORTANT INSURANCE FOR THE AVIATION INDUSTRY:

Our two new 8,000-ton presses are identical!

Kaiser Aluminum will soon have two new 8,000-ton heavy extrusion presses in operation at Halethorpe, Maryland, as part of the Air Force heavy press program.

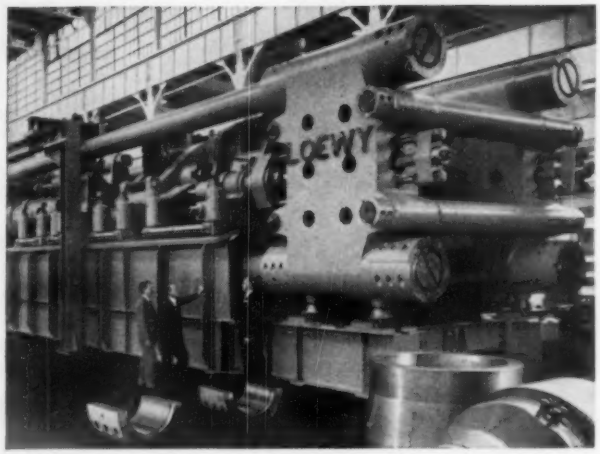
As both presses are of exactly the same size and capacity, Kaiser Aluminum is the only participant in the heavy press program that *can assure you protection of production schedules.*

Because the presses are identical, dies may be moved from one press to the other without modification or delay.

As a result, regardless of any temporary shutdown of either of the two presses, production can continue without interruption. Air frame manufacturers and other users of heavy extrusions are thus insured against delays and disrupted schedules.

Company engineers should prepare designs promptly in order to overcome the required lead-time and benefit from the presses' early operations.

Kaiser Aluminum engineers with long experience in extrusions are available to work with you on your designs. If you would like to see how heavy aluminum extrusions fit into your production, you are urged to take immediate advantage of this service.



Contact Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Illinois; Executive Office, Kaiser Bldg., Oakland 12, Calif.

Kaiser Aluminum

setting the pace—in growth, quality and service

IMPORTANT FACTS ABOUT THE KAISER ALUMINUM HEAVY PRESS PROGRAM:

1. Maximum billet size will be 20" O.D. x 56" long. Extrusion width—up to 17". Substantially wider extrusions can be produced depending upon section design. Maximum weight per piece will be 1,200 lbs. Maximum finished length will be 85 feet.

2. The use of these large extrusions will, in many applications, eliminate the costly production and assembly of several smaller component parts. This means potentially large savings in both money and man-hours to the aircraft, transportation, electrical and other industries.

3. The billets used on these presses will be made using revolutionary degassing and metal handling techniques —a Kaiser Aluminum first. Result: a new order of ingot quality; freedom from gas porosity; highest degree of freedom from inclusions; soundest, highest quality extrusions ever made.

4. The new Kaiser Aluminum heavy extrusion plant is completely equipped and fully integrated for the production of heavy extrusions exclusively.

machine is designed for single or parallel face flat lapping. The unit can be arranged for a plain, timed cycle; automatic continuous feed, or semi-automatic continuous feed.—Norton Co., Worcester 6, Mass.

Chemical balls quickly free open areas of hazardous ice and snow. Ice-Foe will not damage metals, concrete, asphalt or shoes, the maker states.—Walton-March, 1935 Sheridan Rd., Highland Park, Ill.

Quartz spring kit contains five extremely thin precision quartz springs. Load maximums range from 5 gm. to 50 gm. with maximum extension of 5 cm. throughout. Helical springs are all supplied with hook-end attachments.—Houston Technical Laboratories, 2424 Branard, Houston 6, Tex.

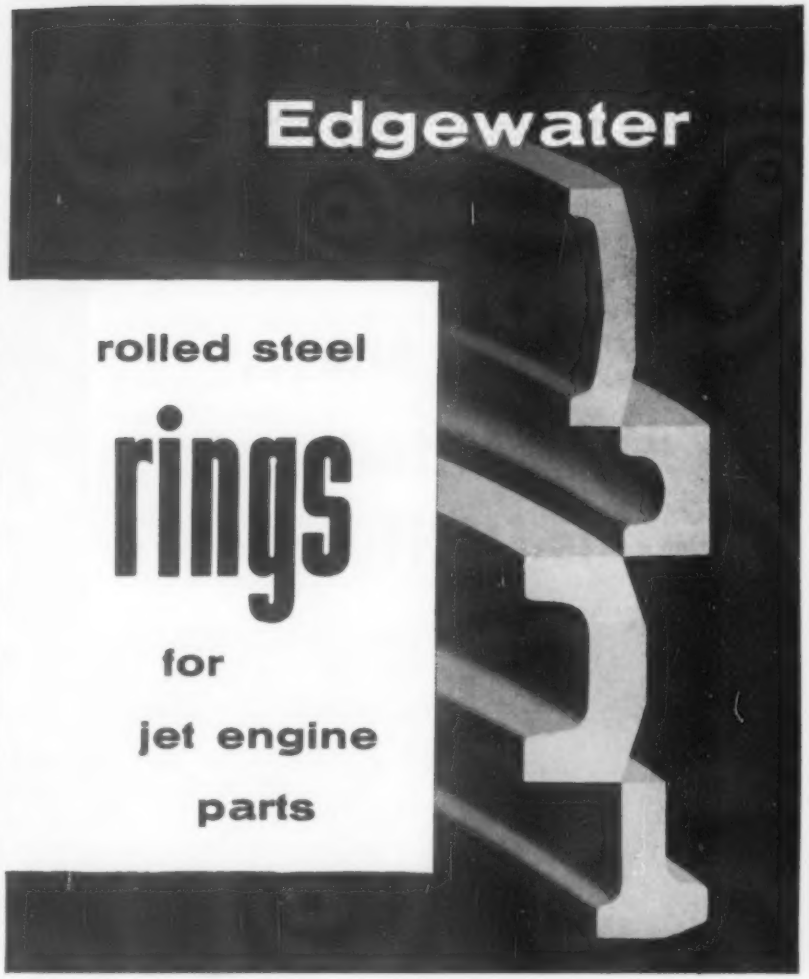
Boring bar is reported to reduce bending or bar deflection while making deeper cuts with heavier feeds by as much as 50%. It is constructed of steel and tungsten carbide in sizes ranging from ⅜ to 1¼ in. diameter.—Cyma Corp., 3581 Kipling Ave., Berkley, Mich.

Oil level sight glasses for helicopter transmissions are shatterproof, resistant to corrosion and aging. Made of Kel-F plastic, the sight glasses are standard equipment in all helicopters produced by Sikorsky Aircraft Corp.—Nichols Engineering, Inc., Shelton, Conn.

Scale-free welding couplings for aluminum piping eliminate the risk of pumping corrosion products or welding scale and icicles into aircraft fuel tanks during servicing operation. The scale-free coupling consists of two forged halves with hub ends that fit pipe and welding fittings.—Tube Turns, Division of National Cylinder Gas Co., Louisville, Ky.

Gripspring, recently developed in Germany and now being manufactured in the U.S., fastens hubs onto a shaft without the use of splines or keyways. Device is wedged between hub and shaft under heavy pressure hand tools. Outer ring expands and the inner ring contracts.—U.S. Automatic Corp., Amherst, Ohio.

Nicrobraz paste is a stainless steel brazing alloy paste for the joining of heat- and corrosion-resistant alloys by torch, induction and similar methods. Its properties include excellent flow and brazing characteristics on stainless steels, nickel base alloys and cobalt base alloys, as well as low alloy and carbon steels, copper and similar alloys; melting point is above 1950F. . . . **Green Stop-off** prevents flow of



• save machining time

• save costly material

Edgewater weldless rings, rolled from solid steel blocks, are made in diameters from 5 inches to 180 inches, and weights up to 14,000 pounds. The cross-section drawings above show some of the shapes produced by the Edgewater rolling process. Simple or complex sections are accurately formed, minimizing machining operations, and reducing material costs.

Among the applications for which Edgewater Rolled Steel Rings are recommended are: turret gears, shroud rings, compressor rings, spacer rings, parts for reciprocating engines.

WRITE for free booklet describing how Edgewater Rolled Steel Rings are made and showing some of the rolled-sections produced by this process.

EDGEWATER STEEL COMPANY

PITTSBURGH 30, PA.

TOMORROW'S AIRCRAFT: One step closer
At Air Arm...
flight testing
is FIGHT testing
EMERGENCY
ONLY

Air Arm has what it takes to develop and produce the best in airborne electronics equipment. A key factor is the Flight Test facility that puts systems through actual tactical situations . . . a facility that is second to none in the industry.

Far from being a fledgling in this activity, Air Arm's Electronic Flight Test Center is three years matured and still expanding. This unique facility is at the main plant and connected by taxi strip to Baltimore's modern Friendship International Airport. Westinghouse owned and operated, it consists of 48,000 square feet of hangar area, electronic test and administrative sections.

FIGHT Testing airborne systems is the job of Air Arm's Flight Test Center. Here, eight former military pilots, men with aviation backgrounds which total over a century of flying experience, keep as many as 16 prop and jet aircraft on the go. They subject equipment to every possible airborne rigor *before* it goes into operational aircraft. 110 highly trained and experienced Flight Test personnel—engineers, technicians, mechanics, armorers and aerologists are working hand in hand to insure that pilot, aircraft and airborne system form a perfectly matched combination for peak efficiency and performance.

Air Arm Flight Test is one of the many specialized facilities which enable us to produce the best in airborne electronics equipment and . . . to help you bring tomorrow's aircraft . . . One Step Closer. Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Maryland. J-91030-B

Chief Project Pilots, Tom Lloyd and Fred Hughes, join on the ground, prior to debriefing, following an afternoon air-to-air gunnery check on a fighter armament system.

THE AIR ARM SYSTEMS FAMILY . . .

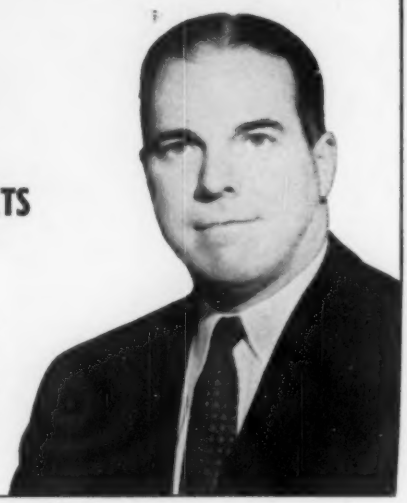
- **Fighter Armament**
- **Bomber Defense**
- **Flight Control**
- **Missile Guidance**
- **Special-Purpose**
- **Systems Components**

YOU CAN BE **SURE**...IF IT'S

Westinghouse

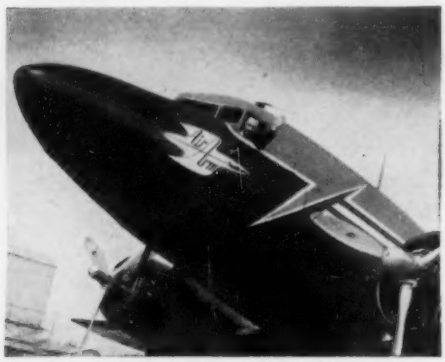
Airborne FIGHT Testing
is one of the many specialized
facilities behind your . . .

AIR ARM MAN WITH THE FACTS



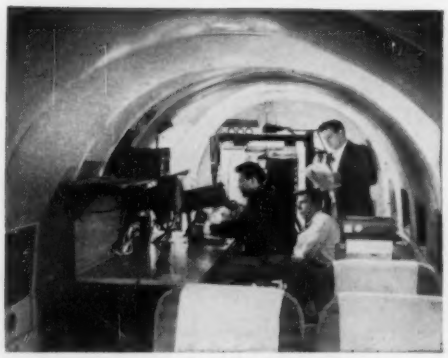
Mr. M. T. Lang

Can Milt Lang help you? Contact him at Westinghouse Electric Corporation, 501 St. Paul Place, Baltimore 2, Md. Telephone PLaza 2-0300. Or see his counterpart in your area through your local Westinghouse office.

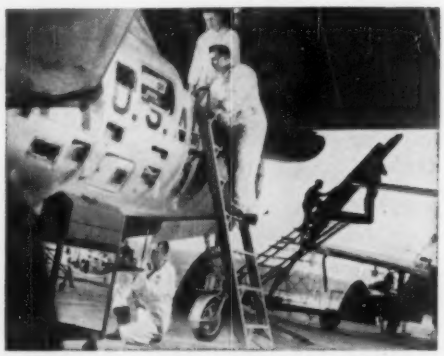


Bill Tyler, in charge of flight activities at the Center, applies his experience to the operation of flying test beds. In the Air Arm DC-3 Flying Lab, equipment gets a positive assessment of flyability.

Tom Lloyd, a chief project pilot, holds briefing with project and supervisory engineers. Finding the difference between simulated and actual performance is the reason for Air Arm Fight Testing.



A new fire control system is getting this Air Arm shakedown, using the DC-3 Flying Lab as the proving ground. All equipment gets this evaluation under actual in-flight tactical situations.



Complete support to operate flying test beds is an integral part of Air Arm. Maintenance is done on all types of aircraft by experienced ground crews using the finest equipment and hangar facilities.

J-91030-A

YOU CAN BE SURE...IF IT'S Westinghouse

brazing alloy across the surface of parts; applied by brushing, spraying or dipping.—Stainless Processing Div., Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich.

Precision bench center, weighing 16 lb., indicates shoulder deviations on a small (2½ in. long) machined part when placed upright against angle surface plate and set up with commercial feeler gages.—Transicoil Corp., Worcester, Montgomery County, Pa.

Semi-automatic heat sealer with single sealing length of 40 in. handles coated or laminated materials to government specifications regardless of wrinkles or splices in the material to be sealed. It contains an automatic tripping device that controls the heat-sealing cycle and requires simple preliminary hand settings for time, heat and pressure.—Product Packaging Engineering, 5747 Marilyn Ave., Culver City, Calif.

Single pilot-operated hydraulic valves for automatic control of hydraulic circuits is the sub-plate type for panel mounting, designed for full 3000 psi. It is available in ¼, ⅜, ½, 1¼ and 1½ in. sizes. The new solenoid is the heavy, continuous duty type, shock resistant and features low power consumption.—Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

Hermetically sealed float level indicator for control or indication of levels of various liquids, weighs 0.9 oz. F-8685 indicator has no exposed metal parts and may be used with solvents, oils, acids and other chemicals. The switch is enclosed in a nylon stem and is actuated by permanent magnets imbedded in the free float. Eighteen-gage nylon-jacketed leads extend through the threaded mount.—Revere Corporation of America, Wallingford, Conn.

Solenoid operated shut-off valve is 4.67 in. long, 2.03 in. wide and 3.5 in. high. Available in tube sizes from ¼ to ½ in. the valve features low current drain, fast action, explosion-proof, operating range 0 to 5000 psi., temperature range −65 to 275 F, flow rates from 0 to 10 gpm.—Mar Vista Engineering Co., 5420 W. 104 St., Los Angeles 45, Calif.

Drafting templates provide electronic and electrical symbols. Made of amber coated vinyl plastic, they are .025 in. thick.—E. F. Twomey Co., Inc., 728 W. 10th Pl., Los Angeles, Calif.

Auto-Tran unit, a straight-line type indexing chassis, provides a standard application to both automatic and semi-automatic assembly operations. Available with 48 to 72 carriers; 3, 6, 9 or 12 in. index travel, and with either

PIONEERING is our business

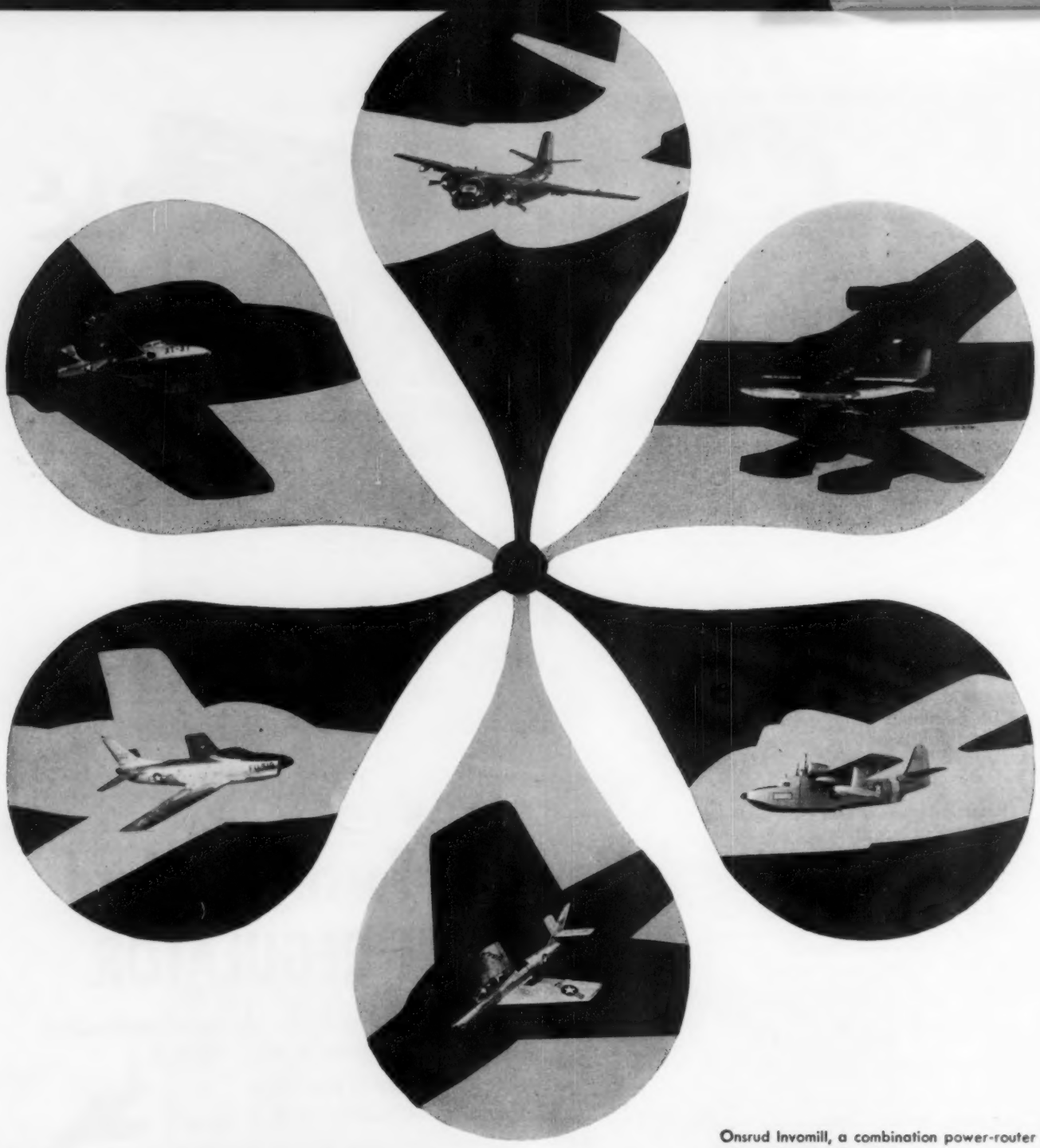
Type D-2A
New Air Force Standard
OXYGEN REGULATOR

Designed for better performance, longer life, easier maintenance
Meets all requirements of MIL-R-8202-B
Already in production
Operates with either mask or helmet
Interchangeable with D-2 type

Never-ending *pioneering* by Bendix has now produced the Bendix Type 2885 (D-2A) Automatic Diluter Demand Pressure Breathing Oxygen Regulator, superseding the Bendix Type 2881 (D-2). The new D-2A is a more efficient performer in every way—the direct result of careful designing and development by the world's most experienced experts in Oxygen Regulators and Liquid Oxygen Converter Systems. For full details, write PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.

West Coast Office: 117 E. Providencia Ave., Burbank, Calif. • Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Pioneer-Central DIVISION
Bendix AVIATION CORPORATION



*Shape of things that come— *from* TWIN COACH*

Piston or jet..single or multi-engine...trainer...interceptor, triphibian or tanker transport —Twin Coach Aircraft Division is probably unique among America's great subcontractors in its ability to produce major assemblies for many different aircraft types.

That's because we're *aircraft* specialists. Twin Coach Aircraft Division's five plants are devoted *exclusively* to production of airframe major assemblies. We build no other products...do no other work.

This is important because it means your airframe assemblies are built by experienced aircraft specialists... *men whose one aim is to produce to specification, on schedule, at the lowest possible cost.*

Onsrud Invomill, a combination power-router and skin-milling machine that can remove up to 150 cu. in. aluminum per minute, is just one of many hundreds of modern, high-speed machines. AA-1639

TWIN COACH COMPANY
Aircraft Division
BUFFALO, N. Y.

Other divisions of Twin Coach Company make:
PONY EXPRESS TRUCKS • FAGEOL GASOLINE AND PROPANE ENGINES
• FAGEOL-LEYLAND DIESEL ENGINES • FAGEOL AEROJET ENGINES

vertical or horizontal mounting surfaces on the carriers. Work carriers attached to a double roller chain have ball bearings mounted in both horizontal and vertical planes, guided in tracks mounted on the chassis frame.—Swanson Tool & Machine Products Co., Erie, Pa.

Aluminum foil laminated to a layer of improved bonding material makes **"Speedy-Cals" nameplates.** These nameplates will stick tightly to any smooth, cohesive surface such as porcelain, glass, plastic and metal or to painted surfaces and will not crack, peel, chip or tarnish. —North Shore Nameplate, Inc., 214.27 Northern Blvd., Bayside, N. Y.

Unitized perforating units, known as "Unipunch," feature a two-piece punch and small button die which provides substantial reduction in the cost of replacement parts. Unit also features a mounting pilot pin, which is concentric with the center-line of the punch and die. The pilot pin is a constant ⅛-in. diameter regardless of the size of the punch or die or whether the punch is round or shaped.—Punch Products Corp., 3800 Highland Ave., Niagara Falls, N. Y.

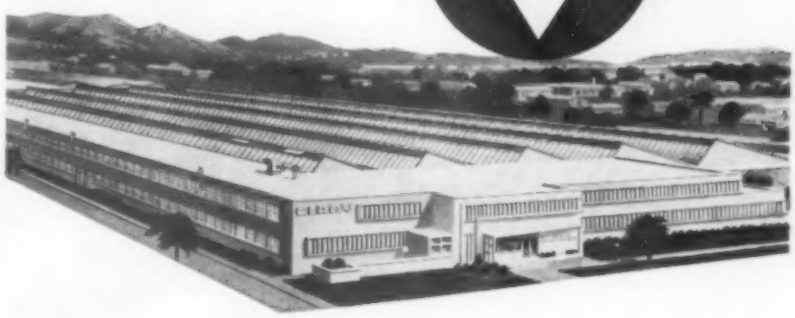
Aeroscreened lanterns radiate scarcely any light above the horizontal, thus preventing the risk of incoming aircraft confusing street lighting with airport approach and runway lighting. Lanterns can be spaced 120 ft. apart and, in some cases, 150 ft. as compared with 90-100 ft. spacing employed with normal "cut-off" lanterns.—General Electric Co. Ltd., Magnet House, Kingsway, W.C.2, London, England.

Semi-elevated, water wash paint spray booths for production spraying have an elevated wash chamber, in which much of paint residue is knocked down and safely contained.—M&E Manufacturing Co., 2571 Winthrop Ave., Indianapolis, Ind.

High speed nameplate marking machine for serial numbering and detail markings, Model MS can put consecutive serial numbers as well as interchangeable legends on two or more bosses. Either hand level or air operated feed mechanism can be used.—Cadillac Stamp Co., 17315 Ryan Rd., Detroit, Mich.

Constant voltage welders available in 500, 750 and 1,200 amp., allow the operator to select the desired arc voltage, which remains constant during the entire welding cycle. The constant voltage feature insures uniform deposit; rod speed and travel rate all remain constant.—Harnischfeger Corp., Milwaukee 46, Wis.

Here at Clary



are the right answers to all your valve problems

Here under one roof at Clary is every facility to solve your fuel, hydraulic, and pneumatic valve problems. Here are excellent design-engineering, manufacturing and laboratory facilities . . . able to produce small valves or large valves . . . existing valves or brand-new ones . . . valves of every description for airframe and missile applications . . . from the small precision Avron valves shown below to complex propellant valves.

So when you think of valves, we hope you'll think of Clary. We'd like very much to be of service to you.

AVRON High Pressure Bleeder Valve, 3,000 psi. Self-sealing, spring and pressure-loaded closed. Bleeds water, air, etc. from pneumatic and hydraulic systems under pressure.

AVRON Air and Fluid Pressure Regulators. Temperature range in qualification tests, −65°F. to +250°F. Relief functions are independent of regulation. Pressurization between 0 and 100 psi, for such uses as reservoirs, compartments, anti-icing, radar wave guide channels, pneumatic and fluid control systems.

AVRON Aircraft Drain Valves. Self-locking and self-sealing. All standard styles and sizes of inlet and outlet fittings are provided for tube, pipe and hose, sizes ¼", ⅜" and ½". For use with all types of aviation fuels, including JP-4, plus other fluids such as alcohol, water, hydraulic fluid, ethylene glycol.

AIRCRAFT DIVISION, Dept. W105
CLARY CORPORATION, San Gabriel, Los Angeles County, California

All business is specialized

. . . and nothing specializes on your business like your business paper

You can sell suntan lotion on Broadway or Beacon Street, but this seagoing salesman can sell a whale of a lot more . . . because he *specializes.*

Your business is specialized, too. That's why it pays to keep up with your business paper. It specializes on business problems you meet every day. It helps you do a whale of a lot better job by keeping you posted on your whole field. You can *move ahead* when you know what's ahead; you can make quicker, surer decisions when you have a clear perspective on what's happening; and you get all this from your business paper.

Every page counts. The editors gather facts, weigh and interpret them. The advertisers line up new products, materials and equipment . . . tell you what they do and where to buy them. To know what's new that's important to you, read *every* issue—thoroughly! It will keep you one of the best informed people in your field.

This business paper in your hand has a plus for you, because it's a member of the Associated Business Publications. It's a paid circulation paper that must earn its readership by its quality . . . And it's one of a leadership group of business papers that work together to add new values, new usefulness, new ways to make the time you give to your business paper still more profitable time.

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet." Room 2710.

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd St., New York 36, N. Y.

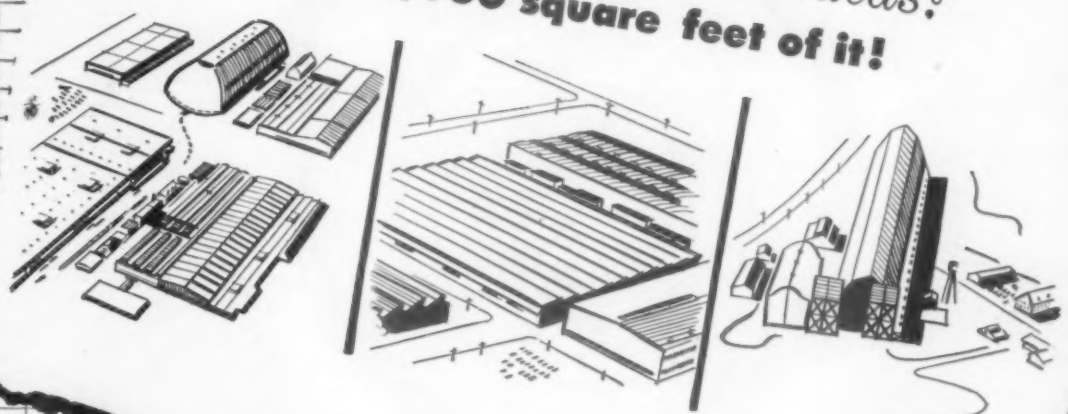
One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

Engineering | **Design**

Research | **Development**

Birthspace for bright ideas?

2,568,000 square feet of it!



Creative engineering ideas need room to grow—like the 1,453,000 square feet of floor space maintained by Goodyear Aircraft Corporation at its Akron plant; the 924,000 square feet at its Litchfield Park, Arizona operation; the 191,000 square feet at its Wingfoot Lake, Ohio facility.

Creative engineering needs modern tools and equipment—like the Goodyear-built computer laboratory, one of the largest and most modern in the world; like the new multimillion dollar engineering building now under way at Goodyear Aircraft, Akron; like the new electronics engineering building and laboratory now under construction at our Arizona plant.

Creative engineers need scope and challenge to thrive—like the pioneering assignments now under way at Goodyear Aircraft in missiles, metallurgy, jets, electronics, airships, plastics, helicopters, radar, guidance, and countless aircraft components.

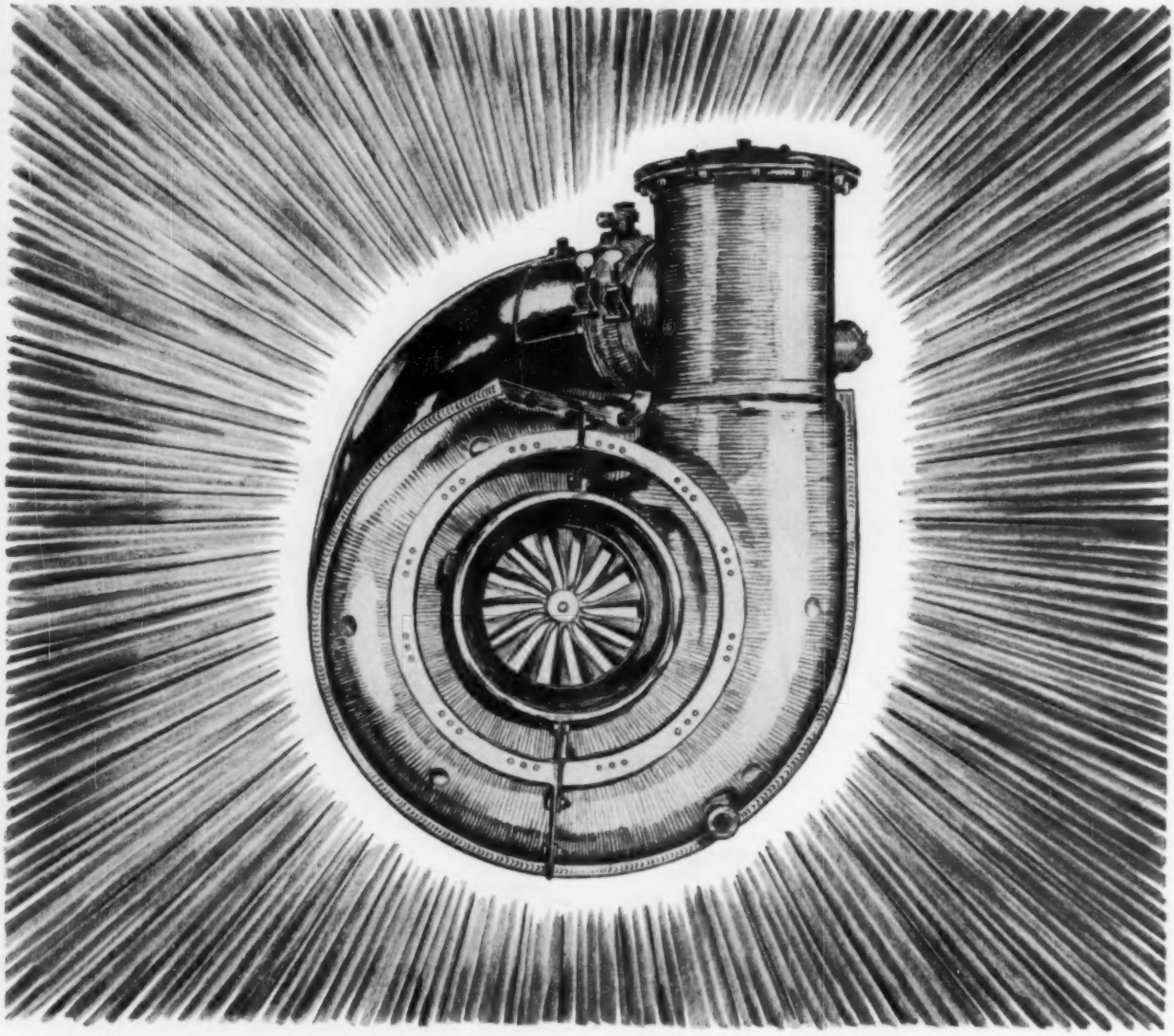
Send resumé, or for application form write: C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio. Plants in Akron and Litchfield Park, Arizona.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS

POWER PLANT OF THE FUTURE



The Solar "Mars®" Gas Turbine Engine

THE SIMPLEST PRACTICAL fuel-burning engine yet constructed is shown above. It is the Solar Mars 50 hp gas turbine. It weighs less than 100 lb and fits in a two-foot cube. It operates on a variety of fuels. Its construction is simple. And the ruggedness of the Mars engine has been proven by many thousands of hours of trouble-free service.

The Mars is a constant speed engine for emergency or stand-by duty where fuel consumption is not of primary importance. Your forward planning should include the Mars gas turbine. For detailed information about this power plant of the future, write today to Solar Aircraft Company, Dept. B-75, San Diego 12, Calif.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO DES MOINES

ENGINEERS WANTED *Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving your experience.*

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS • GAS TURBINES • BELLOWS • CONTROLS • HIGH TEMPERATURE COATINGS • AIRCRAFT COMPONENTS

WHO'S WHERE

(Continued from page 9)

E. M. Deckman, commercial sales manager-aircraft engines of Allison Div., General Motors Corp.

Jerre Manning, manager of transistor division of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

L. E. Tollefson, Washington representative of Douglas Aircraft Co.; **Edward Curtis,** director of contracts.

W. H. D. Hanchet, contracts and service manager of Doman-Fleet Helicopters Ltd., Fort Erie, Ont., Canada.

W. R. Miller, manufacturing director of Longren Aircraft Co., Torrance, Calif.

Jack H. Sheets, works manager of Curtiss-Wright Corp. Also promoted: **Leonard S. Wiener,** chief rocket design engineer of the Propeller Div.; **G. I. Sundstrom,** assistant general manager of Metals Processing Div.; **Melvin Isaacson,** general sales manager; **John G. Rombough,** industrial relations manager.

Robert F. Schulz, manager of microwave and industrial products dept. of Communications & Electronics Div., Motorola Inc. Other appointments: **Leonard G. Walker,** commercial sales director; **James Stewart,** chief of export and special accounts sales.

Howard Capes, publicity director of Decca Navigator Co. Ltd., London, England.

Lee H. Smith, chief of military relations and customer service, Northrop Aircraft, Inc.

Francis A. Oliver, manager of Data Storage Devices Unit of J. B. Rea Co.

Charles T. McKinnie, assistant sales manager, Pratt & Whitney Aircraft Div.

Emerson W. Conlon, assistant to the general manager for future technical product planning at Fairchild Engine Div.; Also promoted: **Elwood D. Bryant,** director of development engineering; **L. Paul Ahlers,** director of quality; **Edward C. Leeson,** director of customer relations.

Guy M. Martin, Jr., sales engineer-Southern California area, DeMornay-Bonardi, Pasadena, Calif.

R. E. Cassatt, commercial sales manager, York Corp., York, Pa.

V. L. Spinney, central region manager, Allis-Chalmers Mfg. Co. Also promoted: **R. L. Halsted,** manager-processing machinery department; **N. W. Landis,** New York district manager; **A. J. Mestier, Jr.,** Detroit manager.

William J. Kent, sales office manager for Leach Relay Div. of Leach Corp.

John F. Ortner, assistant sales manager, Durez Plastics Div. of Hooker Electrochemical Co.

Ralph W. Updegraff, chief industrial engineer of Timken Roller Bearing Co. Also promoted: **Ross Russell,** divisional industrial engineer of Steel & Tube Div.

Kevin P. Moore, aviation sales engineer, AC Spark Plug Div. of General Motors.

George Stevenson, sales coordinator of Circuit Instruments Inc.; **Ernest W. Yonick,** Eastern sales manager of Circuit Instruments, Inc. and Hycor Co., subsidiaries of International Resistance Co.

R. B. Link, United Air Lines manager of ground services at Youngstown, Ohio.

DURING THE DESIGN PERIOD TOO !

the most experienced men in their field can help you . . .

Production problems are best resolved in the designing stage. That is why we recommend consulting us during the design period.

when designing your

EDGE-LIGHTED PANELS and DIALS

. . . our engineers and consultants can save time for your design department and assure the optimum in lighting uniformity, appearance, ruggedness, and simplicity.

Edge-lighted panels and dials for Specification MIL-P-7788, produced by the "Lackon Process" and backed by years of experience in the lighting field, are your assurance of the ultimate in appearance and functional characteristics.

For worthwhile information on edge-lighting, address Dept. AW-10.

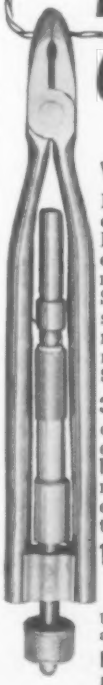
US RADIUM

UNITED STATES RADIUM CORPORATION

Eastern Sales Office — 535 Pearl St., New York 7, N. Y.
Western Sales Office — 5420 Vineland Ave., N. Hollywood, Calif.
Plants and Laboratories at: Bloomsburg, Pa., Whippany, N. J. Bernardsville, N. J., North Hollywood, Calif.

Now! . . . the NEW

DIAGONAL GRIP-HEAD



ROBINSON WIRE TWISTER

Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow, hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety-wiring, 15 oz. **$21.50**
9" —for bench work, sub-assemblies, 12 oz. **$20.50**

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

THIS AD APPEARS EVERY WEEK

SAVE up to 90% of DRAFTING TIME on CIRCLES and ELLIPSES with TWOMEY TEMPLATES

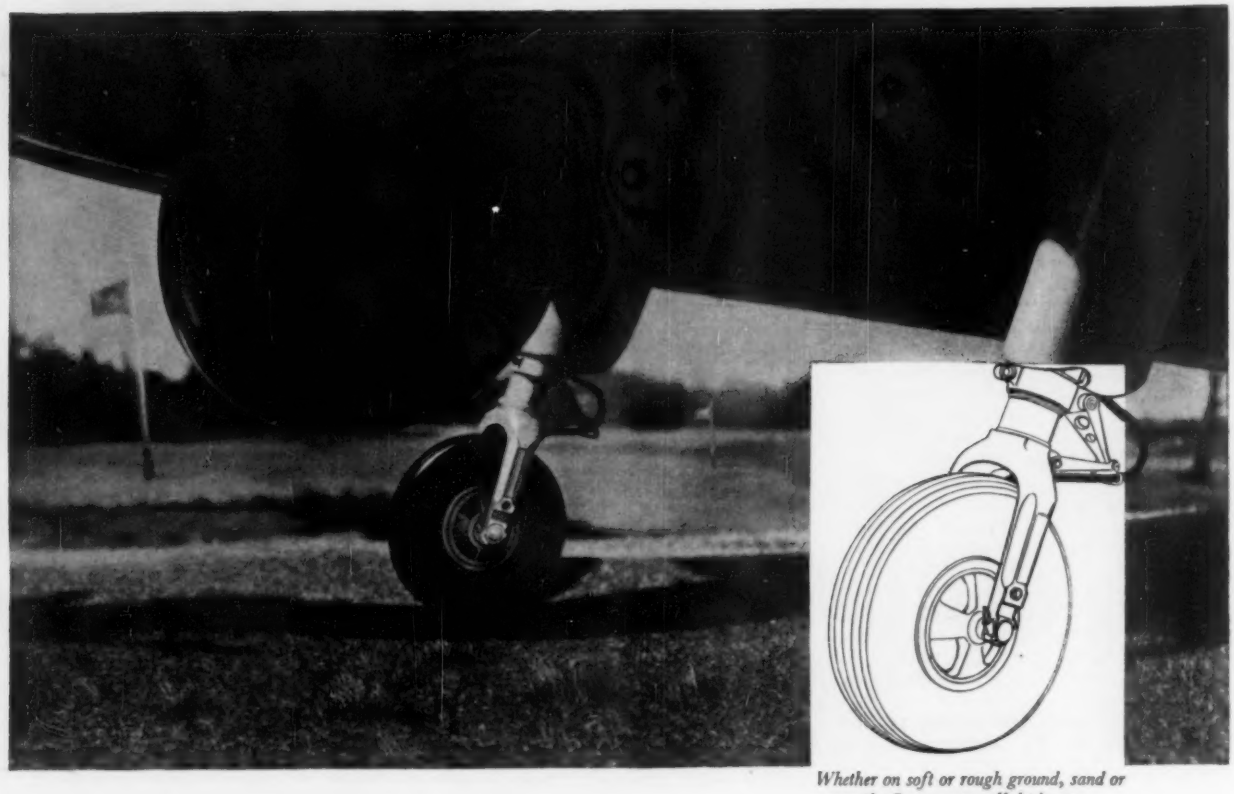
Perfect circles and ellipses required in engineering drawings are time-consuming, troublesome details for engineers. Now you can render them accurately, neatly and quickly with Twomey Drafting Templates. Made of long-lasting plastic, many kinds are available—circles, ellipses, nuts and bolts, lettering, fluid fittings, tooling, sheet thickness—the most complete line on the market. Designed by Douglas Aircraft Co., Inc., they conform to accepted military and engineering specifications and are used throughout industry for speed, accuracy and economy. See your dealer today or write for full details.

Drafting Templates for All Purposes

DEALER INQUIRIES INVITED

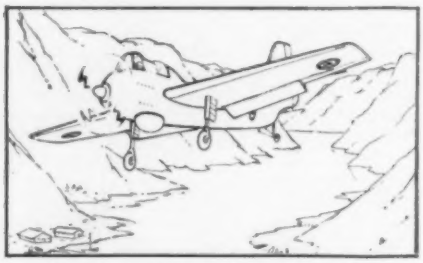
E. F. **TWOMEY CO.** Inc.
726 W. 10th Place
Los Angeles 15, Calif.

Golf course fairway — *Seamew* runway



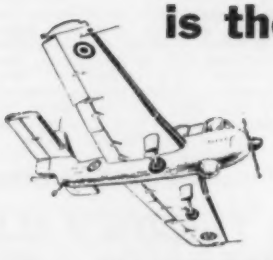
Whether on soft or rough ground, sand or grass, the Seamew can alight in an extremely small area because of its low landing speed and long oleo leg travel. Tyre sizes can be easily changed to suit terrain.

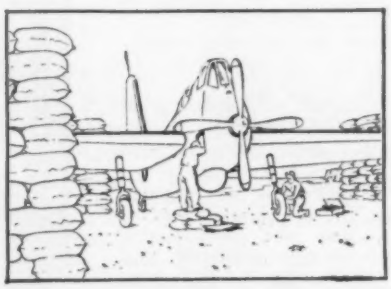
Seamew — a tough, economical, all-weather submarine hunter. In adverse weather — submarine weather — the Seamew can be airborne after a short take-off from an emergency strip . . . can conduct a radar search and low-level attack . . . and can land back safely almost anywhere (even on a golf course!)—due to its slow approach speed and shock-resisting under-carriage.



The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

The *Short* answer is the *Seamew*

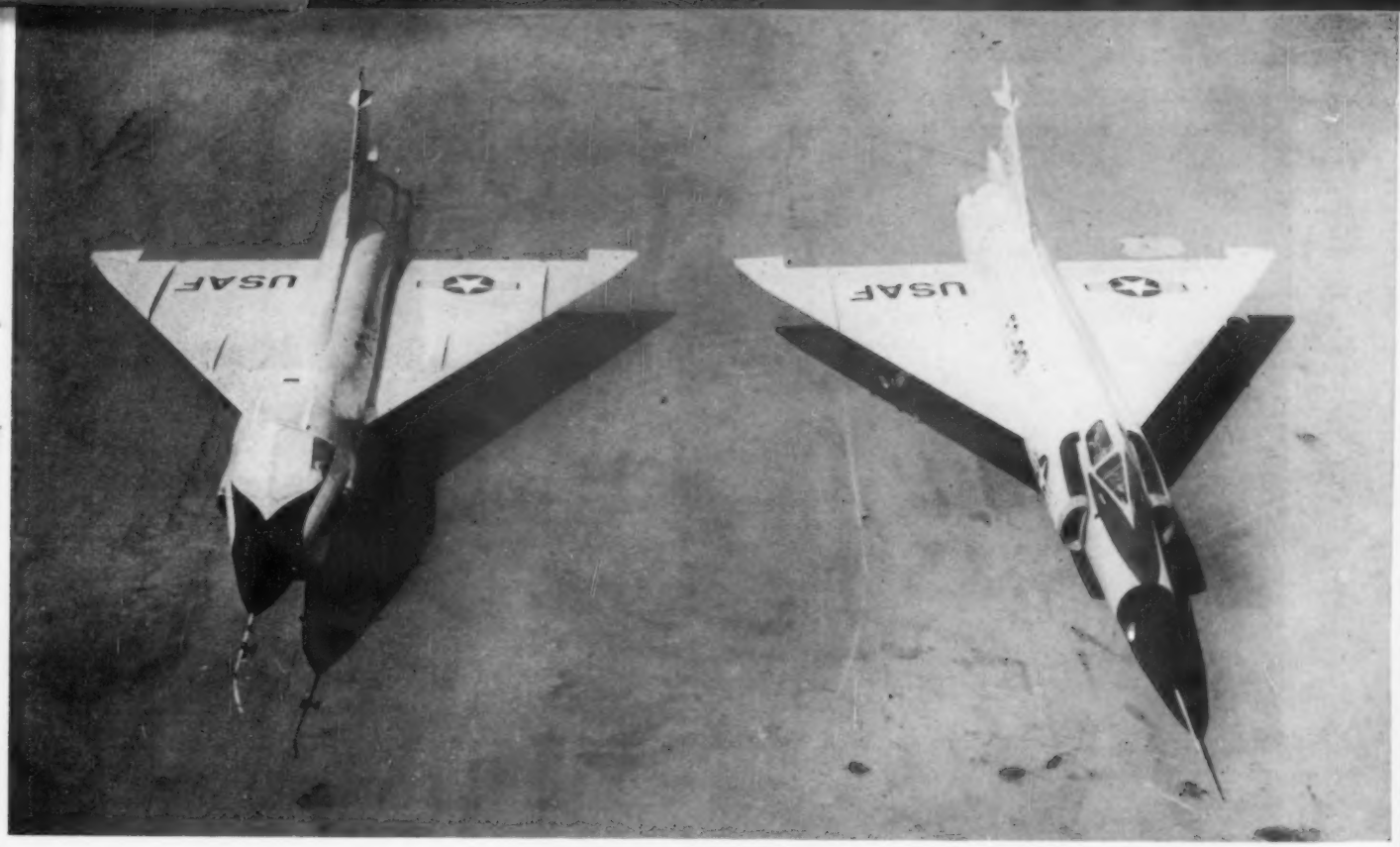




Economy of manufacture is paralleled by economy of maintenance, in terms of man-hours and spare components.

NOW IN PRODUCTION FOR THE ROYAL NAVY AND THE ROYAL AIR FORCE

Short Brothers & Harland Ltd., Queens Island, Belfast, N. Ireland. The first manufacturers of aircraft in the world



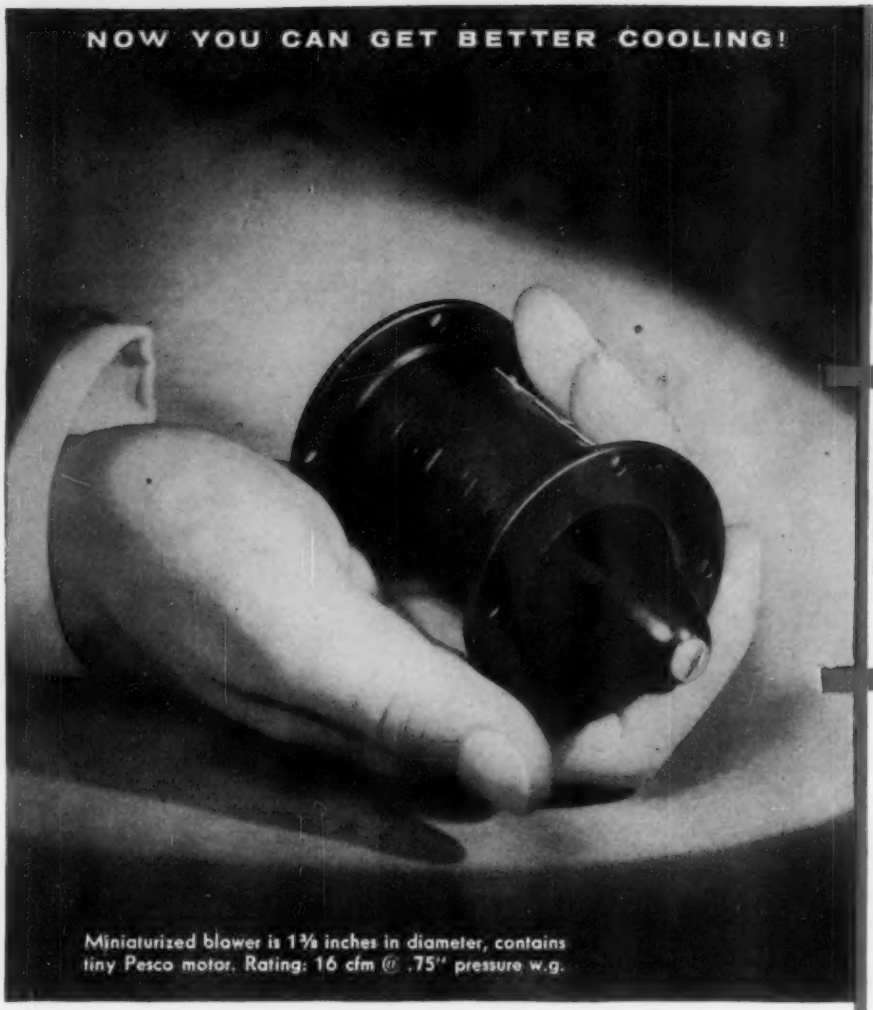
TF-102A:
Trainer-Interceptor

Convair's TF-102A trainer, with side-by-side seating, is the company's answer to the knotty problem of familiarizing a prospective interceptor pilot with flying and fighting a complex unit of a supersonic weapons system.

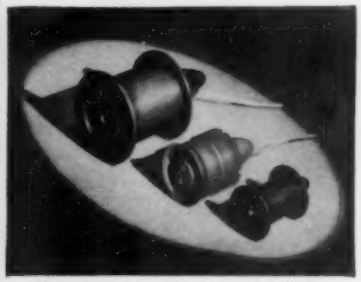
It also may be the company's answer to the criticism of the one-man all-weather fighter, because the trainer also can be flown as a full-tactical weapon by either one or two men.

Length and contours of the original nose —which looks ample for a tandem cockpit— were changed drastically to make the side-by-side layout. This approach adds to the belief that the modified version was designed from the start to serve as a two-man interceptor as well as a trainer.

From the cockpit aft, the trainer and the fighter are identical, their fuselage lines sculptured by the area rule (AW Sept. 12, p. 12). Forward section, although much bulkier, is apparently tailored to the same principle of gradual area buildup. But the shortness of the nose means an "ideal shape" of lower length-diameter ratio had to be chosen for the area control. Such a shape must have a higher drag, and therefore the trainer version—while still a supersonic airplane—must be somewhat slower than the one-man fighter.

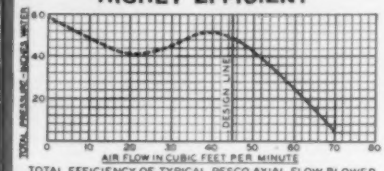

NOW YOU CAN GET BETTER COOLING!
Miniaturized blower is 1⅜ inches in diameter, contains tiny Pesco motor. Rating: 16 cfm @ .75" pressure w.g.

COMPLETE LINE



Units for a-c or d-c operation have capacities from 16 to 750 cfm.

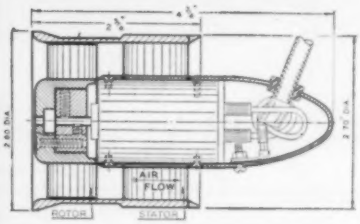
HIGHLY EFFICIENT



TOTAL EFFICIENCY OF TYPICAL PESCO AXIAL FLOW BLOWER 2.75" BLADE TIP DIA - 28v D.C.

Design assures efficiencies unexcelled in comparable "package" sizes.

LIGHTWEIGHT, COMPACT



High air displacement and pressure achieved with minimum size and weight.

new Pesco axial flow blowers

More efficient air delivery or exhaust is possible with the new Axial Flow Blowers now manufactured by PESCO. Engineered by a leading British firm, these advanced design blowers have been proved under tough service conditions. They provide better cooling, heating or ventilating for a wide variety of aircraft and industrial applications.

PESCO® Axial Flow Blowers are self-contained package units which save space and permit more flexible product design. They incorporate a rotor direct coupled to a PESCO Electric Motor for efficient air flow.

An outstanding characteristic of this new PESCO product is the high capacities obtained with minimum power. Careful aerodynamic design assures optimum efficiency with axial air flow. PESCO Blowers withstand severe conditions of shock, temperature, pressure, altitude, humidity and duty cycle. Rated for continuous operation at high ambient temperatures, they perform in any position. Dynamic balancing assures quiet, vibration-free operation. Flange or clip mounting is optional.

Before you proceed with the design or re-design of any equipment requiring localized heating or cooling, investigate the better performance now possible with PESCO Axial Flow Blowers. For complete details, contact your local Pesco representative or write: PESCO, 24700 North Miles Road, Bedford, Ohio.

engineering · Pesco · production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

AVIATION SAFETY

CAB Accident Investigation Report

Shop Error Behind UAL Crash

THE ACCIDENT

A Convair 340, N 73154, owned and operated by United Air Lines, Inc., made a wheels-up emergency landing six miles southeast of Dexter, Iowa (30 miles west of Des Moines), January 19, 1955, at 1625.[1] A few of the 36 passengers received minor injuries; there were no injuries to the crew of three. The aircraft was substantially damaged.

HISTORY OF THE FLIGHT

United Air Lines Flight 329 of January 19, 1955, originated at Newark, New Jersey, with its destination Lincoln, Nebraska, and with intermediate stops scheduled at Allentown, Pennsylvania; Youngstown, Akron, and Cleveland, Ohio; Chicago and Moline, Illinois; Iowa City and Des Moines, Iowa, and Omaha, Nebraska. It departed Newark at approximately 0703 and was routine to Chicago.

At Chicago a customary crew change was made. The new crew consisted of Captain Earl W. Andreason, First Officer Thomas D. Boyle and Stewardess Enid Patricia Johnson. The aircraft departed Chicago at 1330, and the segments of the flight to Moline, Illinois, and Iowa City and Des Moines, Iowa, were normal; no mechanical or operational delays occurred.

Flight 329 departed Des Moines on a VFR (Visual Flight Rules) flight plan at 1608 for Omaha, Nebraska. The gross weight of the aircraft was 45,215 pounds, 1,685 pounds less than the allowable 46,900 pounds. According to company records, the load was properly distributed with respect to the center of gravity of the aircraft.

The climb to 5,000 feet was uneventful but at that altitude the crew noticed vibration and a slight fore-and-aft movement of the control column. The climb was continued to 6,000 feet, where the aircraft was leveled off and power was reduced. As the vibration was still present at this time, the captain attempted to dampen it by engaging the autopilot; however, this was unsuccessful and it was immediately disengaged.

The first officer next lowered the flaps, first to 5 degrees and then to 15 degrees, without any noticeable effect. The "Fasten Seat Belt" sign was turned on and the captain told the first officer to advise the company of their difficulty via radio.

About this time a sudden failure in the control system was felt and it was with extreme difficulty that any semblance of elevator control was maintained. The first officer again tried lowering the flaps, this time to the 24-degree position, but as this did not help to maintain control he returned them to the 15-degree position, where it was found the most favorable results were attained. Accordingly, the first officer transmitted "Mayday" (distress call) on the radio and said that they were attempting to return to Des Moines but were experiencing control trouble.

The buffeting became so severe it was then necessary for the copilot to help the captain hold the control column. However, the buffeting lessened, and the captain advised the first officer to depressurize the aircraft and tell the stewardess to prepare the passengers for an emergency landing. This was done.

By that time, the aircraft had descended below 3,000 feet. Both throttles were retarded in turn to see if the trouble could possibly be caused by one of the engines. This also proved to no avail. The vibration built up to high level and suddenly another failure, in the control system was felt, and the airplane went into a steep climb. As it seemed that a stall was imminent, the captain quickly moved the propellers to a high r. p. m. and pushed the throttles forward until about 50 inches of manifold pressure was seen on the gauges. The airplane then nosed over and began to dive at a very steep angle.

During this rapid descent the captain reduced power and headed toward open

[1]All times herein are Central Standard and are based on the 24-hour clock.

New AMERICAN Inertia Reel

MULTIDIRECTIONAL SHOULDER HARNESS TAKE-UP

MODEL 20

1. **Lightest reel**—about 1.5 lbs.
2. **Thinnest**—1¼" over-all.
3. **Complies with Specification MIL-R-8236 Type MA-2.**
4. **Lowest in cost** of any multidirectional reel.
5. **Positive** in action. Locks instantly on primary crash impact.
6. **Full 18" harness cable travel,** as called for in Specification.
7. **Ideal for ejection seats.** Locks instantly and automatically when electrical circuit is interrupted during ejection cycle.
8. **Manual control is thinnest ever made,** only ½" thick over-all.
9. **Reel cannot be unlocked by quick retracting movement.**
10. **Can be mounted in almost any position,** as inertia locking action is controlled by a new inertia switch, mounted independently of reel. The light weight switch will operate several reels.
11. **Reel can be disassembled** and overhauled by user without returning to factory for recalibration. Only the trouble-free inertia switch is factory-sealed.
12. **Design incorporates suggestions** of aircraft manufacturers. Aircraft engineers available for consultation.
13. Uses same mounting hole spaces as other reels of our manufacture.
14. Mock-up units available for your development work.

We also make Unidirectional Reels conforming to Specifications MIL-R-8236 Type MA-1 and AN-R-29 amend 2.

Original producer of the Inertia Locking Shoulder Harness Safety Reel. Supplier to the Armed Forces since 1945. American Inertia Reels are fully protected by patents.

Your inquiry will be answered promptly.

American Seating Company

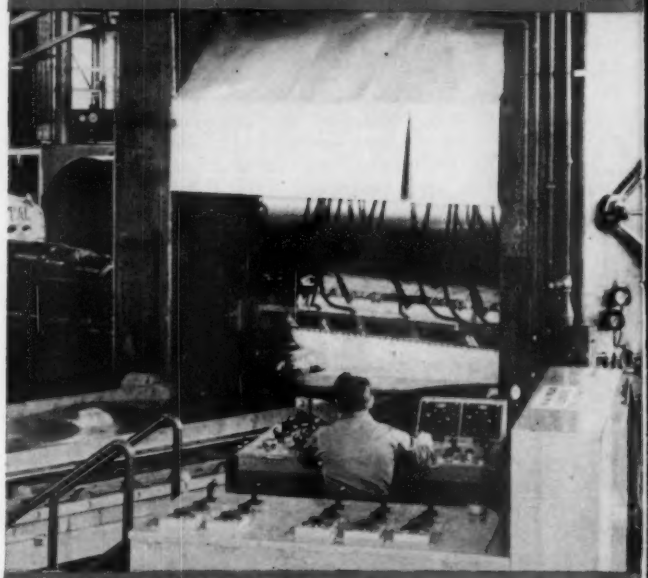
GRAND RAPIDS 2, MICHIGAN • WORLD'S LEADER IN PUBLIC SEATING

AVIATION WEEK

Buyers' Guide

A McGRAW-HILL PUBLICATION

MISSILES:
Airframe and components
Equipment, including ground-handling,
Powerplant



SUPPORTING GROUPS: Data systems computers, punch-card systems etc., Electrical, Ground equipment, Hardware, Hydraulics, Instrumentation, Materials including fuels, chemicals, plastics, metals, etc. Tooling including machine tools, optical jigging systems, hand tools

Brings A Unique, Long-Needed Publishing Service to the Aviation Industry

November 28, 1955, an all-important, needed publishing service will be available to the aviation industry . . . AVIATION WEEK's Annual BUYERS' GUIDE. The dramatic development of aviation into today's multi-billion dollar giant—reaching into all phases of manufacturing—demanding a constant flow of products and materials from tens of thousands of separate suppliers—has made a comprehensive, complete source book of suppliers and manufacturers a must for all segments of the Industry. AVIATION WEEK's BUYERS' GUIDE answers this intelligence need with an information service of year-'round usefulness, placed directly into the hands of some *57,000 key aviation engineers, management men, design and purchasing personnel—men who make up aviation's real buying influences . . . in the industry itself, in the Air Force, and throughout the Government.

The latest developments in military procurement will be covered in a special report. Included in the detailed information to be presented will be: Air Materiel Command—Air Research and Development Command buying practices, personnel listings—by name, procurement centers, etc.; All-inclusive listings of manufacturers of aeronautical and allied products, sectionalized for maximum utility under six major headings: **Aircraft, Missiles, Avionics, Supporting Groups, Nuclear Power Systems, Airlines and Airports.**

Indexing is set up to provide quick, easily referred-to locators for all products. In addition, advertisements and product listings will be keyed to each other for ready reference. AVIATION WEEK's BUYERS' GUIDE also will carry Trade Name and Distributor listings—making this publication **the most complete single source of buying information available to the aviation industry today.**

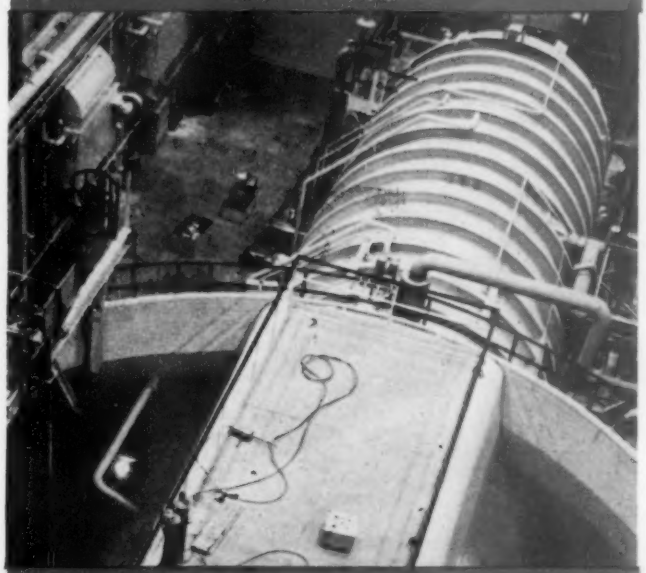
Every AVIATION WEEK subscriber will receive the BUYERS' GUIDE. That's a market of some *57,000 key aviation people . . . plus substantial bonus circulation through the sale of extra copies of the BUYERS' GUIDE to aviation companies and government agencies (Price for additional copies is $3.00 each). AVIATION WEEK's BUYERS' GUIDE will be read, referred to, and depended upon constantly wherever aviation business is transacted.

McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.: Other Advertising Sales Offices: **Atlanta 3, Ga.,** 801 Rhodes-Haverty Bldg. **Boston 16, Mass.,** 350 Park Square Bldg. **Chicago 11, Ill.,** 520 N. Michigan Ave. **Cleveland 15, Ohio,** 1510 Hanna Bldg. **Dallas 1, Texas,** First

Aviation manufacturers, products, and services will be listed under these six major headings.

AIRCRAFT:
Airframe and components,
Landing gear, Powerplant
Armament, Fixed equipment

AIRLINES AND AIRPORTS:
Scheduled carriers, Non-scheduled carriers, Cargo carriers,
Ground equipment, Lighting



NUCLEAR POWER SYSTEMS:
Accessories and components
Design services
Reactor fabrication

AVIONICS: Communications systems & equipment, Radar-fire control systems & equipment, Instrumentation and controls, Navigation systems & equipment, Components and devices, Test equipment, Computers & data processing equipment

Be sure your complete line of products and services is listed in this basic book of buying information. Special discounts are offered for multipage and catalog-type advertisements. Your AVIATION WEEK representative will gladly help you plan your advertising to make the most economical and resultful use of the GUIDE. Call him today.

* Average net paid circulation, 51,893 (June, 1955 ABC Statement). Paid circulation of current weekly issues more than 53,000. Current weekly print order exceeds 57,000.

AVIATION WEEK

A McGRAW-HILL PUBLICATION ABP ABC

National Bank Bldg. **Detroit 26, Mich.,** 856 Penobscot Bldg., **London E. C. 4, England,** 95 Farringdon Street. **Los Angeles 17, Calif.,** 1111 Wilshire Blvd.
Pittsburgh 22, Pa., 919 Oliver Bldg. **Philadelphia 3, Pa.,** 17th and Sansom Streets. **San Francisco 4, Calif.,** 68 Post Street. **St. Louis 8, Mo.,** Continental Bldg.

#23271
3-WAY SOLENOID OPERATED VALVE
3/8" Line size
Weight 0.9 lb.

ADEL

Pneumatic control valves set new performance standards!

#23314
CHECK VALVE
1/4" & 3/8" Line sizes
Weight 0.13 lb.

#27370
SHUTTLE VALVE
1/4" Line size
Weight .290 lb.

#27800
4-WAY SOLENOID OPERATED VALVE
3/8" Line size
Weight 1.80 lb.

ADEL designed and manufactured to provide the best in control equipment where pneumatic systems are specified. Safe, dependable operation is assured with instantaneous reaction at working pressures up to 3000 psi. These production units have been thoroughly tested and are qualified to meet all applicable specifications.

ADEL produces a complete line of AIRCRAFT HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT; HEATER, ANTI-ICING & FUEL SYSTEM EQUIPMENT; ENGINE ACCESSORIES AND LINE SUPPORTS.

For complete engineering specifications and counsel

Address: ADEL DIVISION, GENERAL METALS CORPORATION
10775 Van Owen Street, Burbank, California

ADEL
PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA.

CANADIAN REP. RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

country to his right. When the aircraft reached 500 feet above the ground the captain was successful in flaring the aircraft, and it struck the ground in a flat attitude. All occupants were quickly deplaned as soon as the aircraft stopped.

INVESTIGATION

The aircraft came to a stop heading 195 degrees magnetic and in an upright position with its wheels retracted. It was in a level, snow-covered cornfield approximately six miles southeast of Dexter, Iowa.

From marks on the ground it was determined that the tips of the propeller blades and the antenna attached to the bottom of the fuselage made first contact with the ground. At this time the aircraft was approximately level laterally, and slightly nose-high. The next ground contact was about 900 feet from the first marks found. At this point the aircraft struck the ground and bounced over a barbed-wire fence. It again struck the ground with severe force about 390 feet farther on, hurdled another fence, and skidded in a slight right curve for an additional 1,485 feet. Minor wreckage was strewn along the path.

The underside of the fuselage was crushed upward and the top of the fuselage was badly damaged. All cabin and cockpit seats remained intact. Leading edges of the wings were dented somewhat; the flaps were extended about 15 degrees. All propeller blades were broken. Both engines were still attached to the airplane but their mounts were severely damaged. The snow, which was uniformly five or six inches deep on the ground, considerably lessened the damage the aircraft received during its slide.

Because of the nature of the accident, attention was immediately directed to the empennage and control system of the aircraft. The empennage section was intact and virtually undamaged by ground contact. During the examination of the elevator torque tube assembly, it was observed that there was a vertical fracture of the right side. This completely disconnected the right elevator from the main torque tube assembly, and the pilot could no longer operate this elevator by means of the elevator control system. The left elevator was still attached to the torque tube assembly, however, and partial elevator control could still be effected.

The left elevator servo tab was found hanging in the full down (nose-up) position, with the rear terminal of the aft push-pull tube attached to the tab horn.

Internal inspection of the servo tab assembly revealed that this push-pull tube had broken transversely about 12 inches forward of its rear terminal. The rear portion of the broken tube showed evidence of abrasion over most of its exterior surface, caused by its rapid and violent movement within the elevator. The interior surface of the elevator skin in the area of the tab push-pull rod was seared and abraided, and the skin was punctured in several places.

The inspection doors were opened, and it was found that the servo tab idler was completely detached from its support in the elevator. The $\frac{1}{4}$ x $3\frac{1}{4}$-inch close tolerance support bolt was fractured about one inch from the head end, and this end of the bolt was found in the lower rear flange of the stabilizer 20 inches outboard of the

GYRON-SPECTRE

for the

MIXED-POWER-PLANT

FORMULA

The **GYRON**

a most powerful axial jet engine designed to a formula embracing all the features which are indispensable for supersonic flight.

The **SPECTRE**

a liquid-propellent rocket engine developing its maximum power at altitudes beyond the scope of air-breathing engines.

THE DE HAVILLAND ENGINE COMPANY LIMITED

LEAVESDEN AERODROME, HERTFORDSHIRE, ENGLAND

Checked at every step...

LELAND

airborne equipment is right!

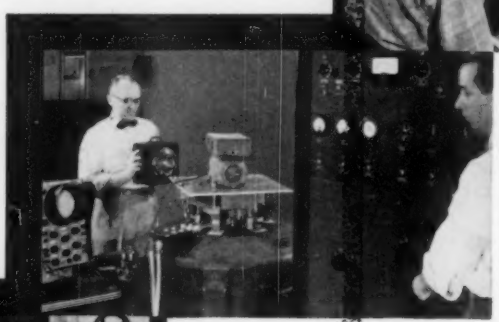
Every piece of airborne electrical equipment that leaves the Leland plant is right and *we know it's right*. Because we've proved it at every stage of its development and manufacture.

Prototype models are tested for performance under extreme conditions of *high- and low-frequency vibration, shock, altitude, temperature, salt spray and humidity...* scientifically checked for *RF noise, dynamic balance...* proved in every possible way with the most modern, most accurate testing equipment.

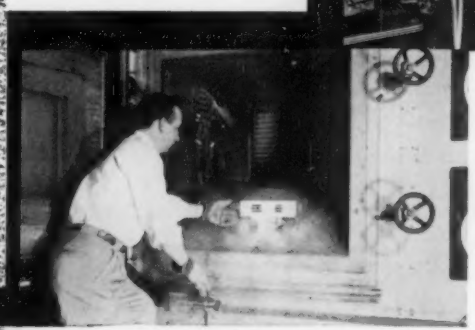
And throughout production, every unit is subjected to this same kind of thorough, conscientious testing to make absolutely certain that the unit you receive meets Leland's *own* highly critical standards.

These complete testing facilities and procedures give you still further assurance that Leland is capable of solving *your* aircraft electrical problem, whether it involves inverters, alternators, generators, or motors.

Why not get in touch with us.



(Ascending)
Prototype assembly shop readies designs for testing. Altitude Chamber duplicates stratospheric conditions. Vibration Test challenges design. Assembly Line Inspection Stations constantly check quality.



Another AMF Product

LELAND
AIRCRAFT PRODUCTS

THE LELAND ELECTRIC COMPANY
Division of American Machine & Foundry Company
Dayton 1, Ohio
In Canada: Leland Electric Canada, Ltd., Guelph, Ontario

Make a note to see us at
BOOTH 6
AIRCRAFT ELECTRICAL SOCIETY DISPLAY
Oct. 27-28
Pan Pacific Auditorium
Los Angeles

idler. The remaining portion of the idler rear spar support bolt was found in place in the idler with its fractured end flush with the inboard face of the idler; its broken end was battered. A ¼-inch castellated nut and two washers of the size and type used with the support bolt were recovered from a fold in the seal balance curtain. No cotter pin was found.

The hinge cutouts on the tab were torn rearward, indicating there had been a violent oscillation of the tab resulting in considerable overtravel.

The elevator closing spar was crushed and deformed upward by action of the servo tab horn and push-pull rod. The inner face of each idler link support bracket was severely battered and abraided near and downward from the support bolt bushing.

It was determined that the aircraft was properly dispatched and that weather was not a factor in this accident.

A study of the maintenance records disclosed that on January 18 and 19, 1955, this aircraft underwent a 1,500-hour inspection at the company's line maintenance base at Newark. After completion of this inspection, the aircraft flew approximately five hours before the accident occurred.

To understand better the chain of events that occurred with respect to work performed on this aircraft, it was advisable to examine the line of command with respect to personnel at the Newark base, and their working hours. The base is headed by a station manager, who has under him a chief mechanic, supervisors of mechancial services (crew chiefs), inspectors, lead mechanics, and mechanics. There are three 8-hour shifts daily beginning at 12 midnight, with personnel reporting for duty 30 minutes before each shift. Top supervisory personnel above the crew chief level are a part of each shift or are available by telephone if needed.

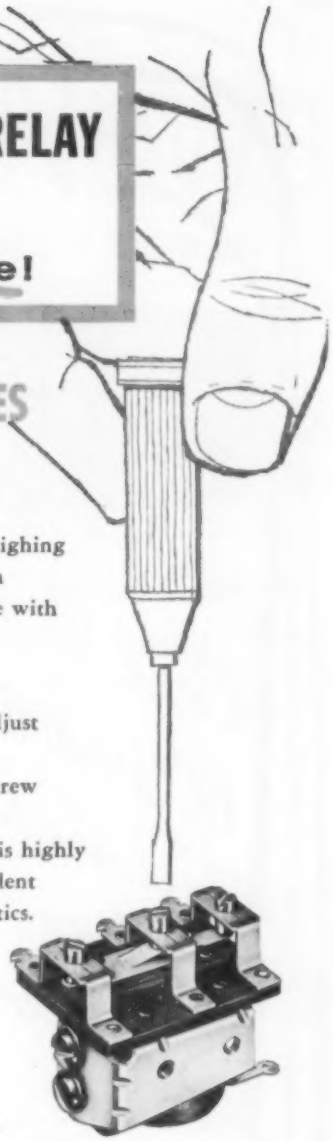
The card system used in the allocation of work comprises a work control record, a routine job card and a nonroutine job card. The work control record is a master card that lists all the work to be performed. Routine job cards are distributed among the mechanics according to the number of areas necessary to be covered for each individual inspection. Nonroutine job cards are made out and initialed by mechanics when they encounter work necessary to be done other than that specified on the routine job card.

N 73154 was in the shop ready for a 1,500-hour check at the start of the 8:00 a.m.-4:00 p.m. shift the morning of January 18. During the inspection of the empennage, which involved a detailed inspection of the horizontal stabilizer, elevator and related control system components, it was found that there was excessive play in the elevator servo tab. A nonroutine job card was made out by the mechanic but no corrective action was taken because of the proximity of a shift change. The crew chief going off duty briefed the crew chief on the afternoon shift on the required work. The card indicating that repair of the servo tab was necessary was then given to another A & E mechanic.

The idler linkage was disassembled to determine the cause of the play and it was found that the idler support bolt was considerably worn. The mechanic left the bolt with his crew chief for examination and returned to his work. This particular type

UNIQUE SENSITIVE RELAY

incredibly small, lightweight and adjustable!



ADVANCE "SO" SERIES

Here for the first time is a sensitive relay only 1-7/32"x 1-1/8"x 1-1/4"... weighing only 1-1/2 ounces, and adjustable over a wide range. You get much more latitude with this relay in designing for tiny areas.

The Advance "SO" is set at the factory to operate on 10 milliwatts. User can adjust it down to 2 milliwatts, or any desired pick-up or drop-out, by means of fine screw contacts. A balanced armature provides extremely sensitive operation. The unit is highly efficient, ruggedly built, and offers excellent shock and vibration-resistant characteristics.

Contact arrangement is SPDT. Coil resistances: 4000, 6500 and 10,000 ohms. Life expectancy: 250,000 operations. Available in open types... dust-tight or hermetically sealed enclosures. Now in quantity production, Advance "SO" relays are priced amazingly low. Write for literature.

Coil Resistance	Pick Up Voltage	Pick Up Current	Drop Out Voltage	Drop Out Current	Max. Coil Voltage for Continuous Duty	Overtravel	Contact Gap
4000	6.4 V	1.6 MA	3.2 V	.8 MA	110 V	.0015	.002/.003
6500	8.1 V	1.25 MA	3.9 V	.6 MA	140 V	.0015	.002/.003
10,000	10 V	1 MA	5 V	.5 MA	175 V	.0015	.002/.003

ADVANCE ELECTRIC AND RELAY CO.

AN ELGIN NATIONAL WATCH COMPANY AFFILIATE

2435 N. NAOMI STREET, BURBANK, CALIF.

ADVANCE RELAYS

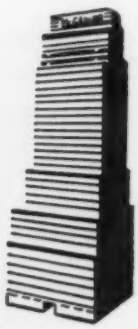
If Your Government Contract....

...or Your Regular Product Requires MANUALS

Call in the McGraw-Hill Technical Writing Service

- OPERATION
- SERVICE
- OVERHAUL
- PARTS CATALOG
- TRAINING

Whether you need one or a set of manuals written and illustrated precisely to meet Government specifications or whether your products are such that instructions on their proper installation, operation, and service must be provided — Technical Writing Service can do the job for you . . . efficiently . . . effectively . . . economically. Technical knowledge and writing skill are the keynotes of our service.



Write or Phone

TECHNICAL WRITING SERVICE
McGraw-Hill Book Company, Inc.
330 West 42nd Street
New York 36, New York

Tel: LOngacre 4-3000

bolt was not in stock, and an emergency order was issued requesting that it be sent immediately from the company's base at San Francisco. This emergency order was written up on the nonroutine job card.

The mechanic later testified that the worn bolt was returned to him by the lead mechanic with the instruction to put it back in the idler assembly loosely (finger-tight). The worn bolt was then replaced but not safetied. No explanation was written on the nonroutine job card covering this temporary installation. This was contrary to the company's maintenance instructions.

When the midnight shift came on duty there was a heavy workload and the new crew chief (who was the only one assigned on that shift—normally there are two) was not briefed with respect to the worn bolt.

The work on the aircraft continued, in a normal manner and, when completed, the supervisor noticed that the subject nonroutine job card had not been signed off as completed. At this time, however, the mechanic assigned to the job reported to the supervisor that he could not find any excessive play in the servo tab assembly. Accordingly, an inspector was requested to check and determine if this was so. He returned in a short time and said that he also could find none.

The supervisor then went to the job with the inspector and from the ground watched while the tab was checked for free play. Observing no excessive play, the supervisor initialed the nonroutine card, adding the notation "OK for service."

ANALYSIS

Correlation of known physical facts with crew testimony indicates the following sequence of failure. The unkeyed castellated nut which fastens the idler assembly support bolt in its brackets backed off because of vibration. This permitted the bolt to come out of the outboard bracket.

With the idler supported only by the bolt through the inboard bracket, forces were exerted which broke the bolt one inch from its head. This allowed the idler to drop down and the servo tab began to oscillate, causing a forward and rearward movement of the cockpit control column. Loads were then induced in the rear push-pull tube causing it to fail. With the then unrestrained tab oscillating, the left elevator was also affected so that it, too, oscillated about its hinge line.

The resultant loads caused by the left and right elevators being out of phase broke the right side torque tube connector plate, eliminating the right support for the torque tube assembly and preventing cockpit control of the right elevator. Without the right support, forces deformed the torque tube assembly forward about the left support, resulting in almost negligible control of the left elevator from the cockpit.

A thorough study of the company's line maintenance procedures, encompassing its record control system, was made during the investigation of this accident.

As a result of this study, and the testimony of the witnesses called at the public hearing, it was determined that the carrier's maintenance program and the detailed procedures set up to it were adequate.

In this instance, however, the procedures broke down because of the frailties of the human element. The system provided safe-

DOW CORNING CORPORATION

Silicone News

FOR DESIGN ENGINEERS

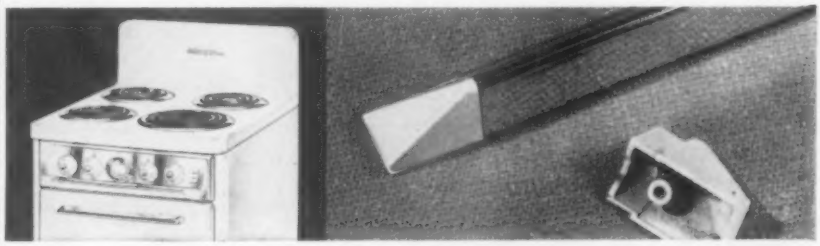
Silicone Fluid Used to Obtain More Uniform Gage Response

While the viscosity of most fluids changes with temperature, Dow Corning 200 Fluids have relatively flat viscosity-temperature slopes. This characteristic plus nonvolatility and excellent resistance to oxidation and mechanical shearing make these silicone fluids ideal for use as damping and hydraulic media in such devices as the dairy homogenizer pressure gage manufactured by Taylor Instrument Company.

Initially, the hydraulic system used to translate volumetric pressures into the pinion-and-sector gear that controls the dial indicator of the gage, contained a glycerine and water solution. But the viscosity of the solution varied with changing temperatures causing the response time of the gage to vary accordingly.

After an adjustable orifice installed in the hydraulic system failed to solve the difficulty, Taylor engineers replaced the troublesome water solution with a Dow Corning 200 Fluid. Showing very little change in viscosity at operating temperatures ranging from 50 to 100 F, the silicone fluid keeps the gages operating uniformly in any dairy without further readjustment.

Taylor also uses two silicone compounds in the gage to assure accurate, dependable service. One of these materials, applied to the pinion-and-sector movement, dampens vibration and greatly lengthens gear life. Dow Corning 11 Compound is coated on the O-ring sealing the faceplate to prevent moisture from entering and fogging the glass. *No. 52*



Silicone Finish Protects and Keeps Die-Cast Range Parts White in Spite of Oven Heat

With properties midway between those of organic paints and vitreous enamels, silicone-based finishes maintain the appearance and prevent the rusting of stacks, space heaters, jet engine parts or kitchen ranges. One of the early users of silicone-based paints on space heaters, Perfection Stove Co. of Cleveland, is now using them on die cast parts and accessories. Here's the story of one of their recent applications.

The oven door of one of Perfection's ranges is left ajar when the broiler is in operation. This is done to keep the temperature in the oven below the point at which the oven thermostat is set to turn off the heat. A deflector bar is fastened above the oven door with two die-cast end-brackets to protect the plastic control knobs against the heat that passes through the slightly opened oven door.

These brackets are painted white to match the rest of the range. When conventional paints showed signs of early failure, Perfection substituted a white Nubelon finish based on modified silicone resins and formulated by Glidden. This silicone finish shows no sign of cracking, peeling or browning even after long exposure to oven heat.

This is the way the finish is applied. The die-cast parts are degreased and given a phosphate surface treatment to improve adhesion. After heating for 15 to 20 minutes at 375 F, the parts are sprayed with the silicone finish, thinned 3 to 1. They are then baked for one hour at 375 F. *No. 51*

44 Silicone Grease Used In Juke Box

The effectiveness of most organic greases is greatly reduced by unusually high or low temperatures. That is why semi-inorganic Dow Corning 44 Grease is the specified lubricant for the popular 80 record juke box produced by AMI Corporation of Grand Rapids.

Applied to the exposed moving parts of the music machine, this silicone lubricant withstands temperatures ranging from —40 to 350 F, assuring proper lubrication and trouble-free operation of installations in any climate.

Dow Corning 44 Silicone Grease has proved to be such an effective lubricant for this particular application that it has now become a standard practice for every AMI repairman to carry a tube in his regular repair kit. *No. 53*

Design Edition 13

DOW CORNING CORPORATION - Dept. 0910-B
Midland, Michigan

Please send me 51 52 53

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE___ STATE_____

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C. (Silver Spring, Md.)
Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones Ltd., London; **France:** St. Gobain, Paris

Wicks

24-HOUR CLOCK

DIRECT READING, SYNCHRONOUS, SELF STARTING

Patented precision design. Five mechanically-interlocked metal drum dials. Seconds dial with C. A. A. color quadrants. Indirect illumination. For 115-volt, 60-cycle operation.

Universal Model (illustrated). only 7-7/16" wide x 4-13/16" high x 4½" deep.

Desk Model available for desk, table, or shelf use. Panel Model available for mounting in standard 19-inch rack.

Desk and Panel Models supplied complete with built-in dimmer/off control and push-button synchronizing switch.

Write for Descriptive Literature

Wicks ENGINEERING AND CONSTRUCTION COMPANY

ESTABLISHED 1920

12TH STREET AND FERRY AVENUE CAMDEN 4, NEW JERSEY

Complete Up-to-Date Information on United States Airports

THE NEW 1955-56 AIRPORT DIRECTORY AND BUSINESS FLYERS' GUIDE

Is just off the press. It lists more than 6,000 airports . . . by exact latitude and longitude, number and types of runways, lights and markings, obstructions, radio and weather facilities, repair service, hangars, restaurants—even bus and taxi service. Among many other exclusive useful features are tips on weather and navigation, a map of all CAA regions, and data on varying state gasoline taxes. A *free* United States Planning Chart goes with every copy.

The price is $4.00 per copy. Send your check or money order to:

AIRPORT DIRECTORY McGRAW-HILL PUBLISHING CO.
330 W. 42nd St., New York 36, N.Y.

guards, one of which required that an explanation of all work performed be written on the respective nonroutine job card; another, that the outgoing crew chief at the time of the work shift brief, in as much detail as necessary, the relieving crew chief concerning the work accomplished during the foregoing work period. These company procedures were not followed in this case.

When the final inspection for play in the servo tab was made, no excessive play was found. It was testified to that, if the worn support bolt was replaced and by chance turned from its position when removed, a manual test for play might result in none being found.

However, since the nonroutine job card was written up for work to be done and was not signed by the mechanic to indicate that the work had been accomplished, it is believed that the inspector making the final inspection should have gone beyond the normal instructions and actually examined the servo tab system. If this had been done the mistake probably would have been discovered before the mechanic was told to close all inspection covers and doors.

The critical omission was the failure to write an explanation on the job card that the bolt had been removed and replaced only finger-tight pending the arrival of a new bolt.

As a result of this accident, the company has increased the number of both supervisory personnel and mechanics.

The Board believes the crew was confronted with an extremely hazardous situation and that it was only by employing the utmost judgment and skill that a disaster was avoided.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The crew, the aircraft, and the carrier were currently certificated.
2. The aircraft was under its allowable gross weight and the load was distributed so that the center of gravity was within approved limits.
3. The aircraft was properly dispatched.
4. Weather was not a factor.
5. During a routine maintenance inspection of the aircraft an explanation was not written on the nonroutine job card that the bolt had been removed and replaced finger-tight pending the arrival of a new bolt.
6. Final inspection of the servo tab system failed to disclose its unairworthy condition and the aircraft was released for service.
7. Vibration backed off an unsafetied nut in the servo tab system, resulting in a sequence of structural failures that ended in almost complete loss of control of the aircraft elevators.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a series of omissions made by maintenance personnel during a scheduled inspection which resulted in the release of the aircraft in an unairworthy condition and an almost complete loss of elevator control during flight.

By the Civil Aeronautics Board:

ROSS RIZLEY
JOSEPH P. ADAMS
JOSH LEE
CHAN GURNEY
HARMAR D. DENNY

■ **MANAGER—FIELD INSTALLATION AND EVALUATION**—Organize and direct activities of a large group of evaluation engineers, involving system functions of computers, radars and fire control equipment. BSEE, 15 years' experience in development and evaluation of electronic equipment (5 years' technical evaluation of major missile guidance systems).

■ **PROJECT LEADER—DATA PROCESSING**—Supervise project activities involving radar video processing equipment (analog and digital). BSEE, 10 to 15 years' experience in development and design of electronic equipment (5 years' project direction). Experience with communication equipment desirable.

■ **PROJECT ENGINEER**—Prepare comprehensive engineering reports by consultation with development engineers. BSEE, 5 years' experience in design and evaluation of electronic equipment, plus several years in the preparation of engineering reports and manuals. Knowledge of radar fire control desirable.

■ **PROJECT LEADER—FIRE CONTROL**—Technically lead a fire control project. BSEE, 10 years' electronic experience, including design, development, organization and technical direction of major projects (5 years in fire control, including tactical and control displays and human engineering). Radars and data extrapolation experience desired.

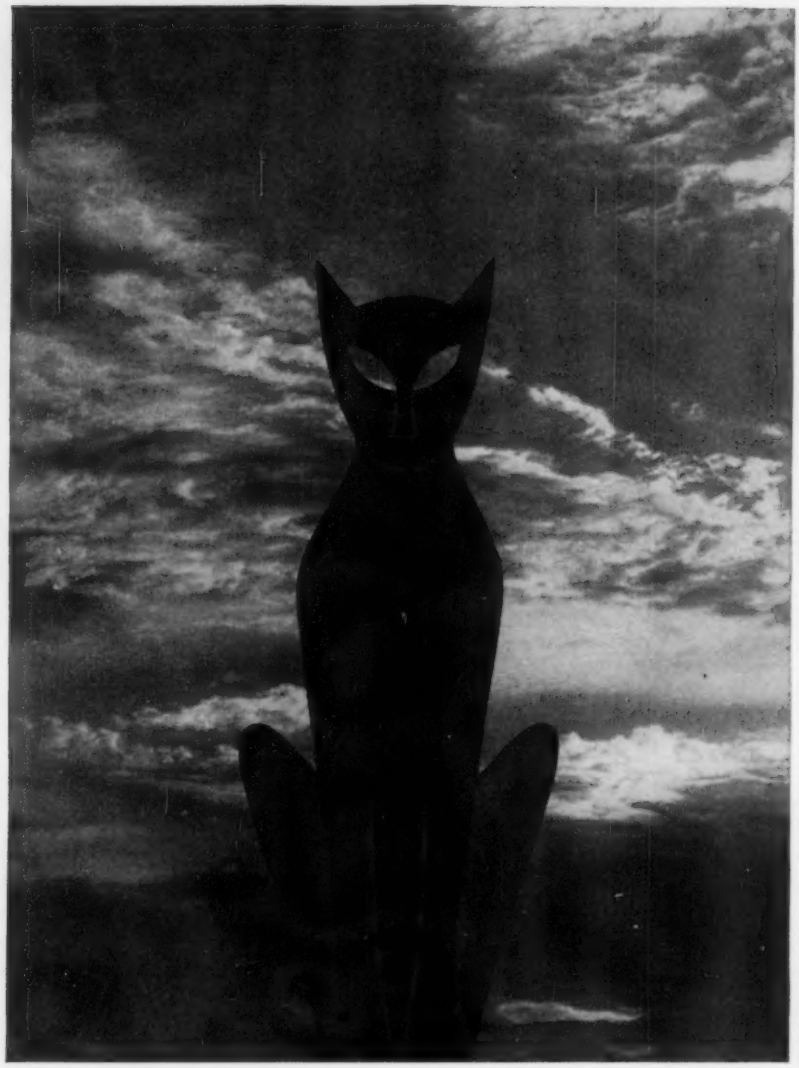
■ **PROJECT ENGINEER—ANALOG COMPUTER**—Assume project responsibility and technically direct major portions of a fire control analog computer project. BSEE, 10 years' experience in electronics, including design, development, organization and technical direction of major projects; 4 years' experience in design and development of analog computers required.

■ **SYSTEMS ENGINEER**—Experience in broad systems design or definite indication of promise is essential. BSEE, 8 to 12 years' experience in electronics of radar and guided missile systems; 5 years in design and development of radar and electronic circuitry required.

Please send resume of your qualifications to:

Mr. John R. Weld, Employment Manager
Dept. B-2K, Radio Corporation of America
30 Rockefeller Plaza, New York 20, N. Y.

RCA® **RADIO CORPORATION OF AMERICA**



believe in luck?

Is it *luck* when a man reaches the top before he's forty?

Certainly... if it is considered lucky to have ability, plus the good sense to find a working environment which is right for that ability.

It is that kind of "luck" which has resulted in the development of new management methods that are years ahead of the calendar *by one of the youngest management groups in the aircraft industry today.*

You don't need a rabbit's foot to find out what is happening at Martin . . . and what it might mean for your future.

Write to J. M. Hollyday, Dept. A-10, The Martin Company, Baltimore 3, Maryland.

MARTIN
BALTIMORE

ENGINEERS

PERMANENT CREATIVE OPPORTUNITIES FOR

ELECTRICAL AND MECHANICAL ENGINEERS

AT

Bendix

Immediate openings for . . . .

SENIOR COMPUTER ENGINEER

At least five years experience with analog computers with control applications. A degree in electrical engineering, or math and physics required. Activity is in the field of aircraft and missile power plant controls, including gas turbine, ram jet, and rocket types. Work will be with hydra-mechanical, pneumatic and electrical components. The fuel metering research facility includes an analog computer and jet engine simulators.

MAGNETIC AMPLIFIER SYSTEMS ENGINEER

Electrical engineer supervisory capacity on research and development of magnetic amplifier circuitry, control systems, and component design and testing, supervising other engineers and technicians.

COMPUTER ENGINEER

Graduate engineers thoroughly qualified as a digital computer programmer, capable of handling engineering and production calculations, to train present personnel in preparation of data for computer applications. Set up new applications. Work with complex dynamics and control problems characteristic of the jet engine fuel system and landing gear fields.

LIQUID PROPELLANT ROCKET CONTROLS ENGINEER

Mechanical or electrical engineer to supervise the research and development of liquid propellant rocket controls, systems design, component design, development and testing.

The salary of these positions will be determined by your ability and experience.

Send detailed resume listing education, engineering experience, and salary requirement to:

TECHNICAL EMPLOYMENT DEPARTMENT
BENDIX PRODUCTS DIVISION OF
BENDIX AVIATION CORPORATION
401 North Bendix Drive
South Bend 20, Indiana

We guarantee you an immediate reply—

Attention!

NON-CITIZEN ENGINEERS & DESIGNERS...

...now you can work at Republic Aviation Corporation through a liberal new arrangement made available to all engineers and designers experienced in the Aircraft and Guided Missiles fields.

If you have had 5 or more years experience in AERONAUTICAL ENGINEERING and DESIGN – emphasizing one or more of the following areas, Republic may have an important position for you in:

AERODYNAMICS	WEIGHTS
DYNAMICS	AIRCRAFT & MISSILE DESIGN
FLIGHT TEST	PRELIMINARY DESIGN
THERMODYNAMICS	ELECTRONICS
FLUTTER & VIBRATIONS	CONTROLS
STRESS	SYSTEMS

Today Republic's famous Thunderjets and Thunderstreaks are in service throughout the free world. These planes, as well as the new RF-84F Thunderflash, form part of the striking arm of the air forces of the U. S. and other NATO countries. Soon to appear are the F-103 and F-105, while planes embodying advanced aerodynamic concepts are already in the mock-up and prototype stage. Still others are on Republic's drafting tables.

AND TO WORK FOR REPUBLIC IS TO LIVE ON LONG ISLAND! You'll enjoy living in the playground of the East Coast, with its fine suburban communities, modern highways, miles of beaches and many state parks.

RELOCATION EXPENSES PAID...LIBERAL BENEFITS. Republic relieves you and your family of all financial worries connected with moving to a new position on Long Island. The company also pays life, health and accident insurance – up to $20,000 – for you, plus hospital-surgical benefits for the whole family, and ⅔ the cost of your collegiate and graduate studies.

If you wish to join the select group of Republic engineers, no matter where you are located now, write promptly, describing your experience and training in detail. A convenient interview can be arranged ***in your vicinity.***

Address:
Mr. R. L. Bortner
Assistant Chief Engineer

REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, NEW YORK

Become a Flight Officer with United Air Lines

New booklet tells you how

United Air Lines—the nation's fastest growing airline—offers unusual career opportunities for Flight Officers.

To qualify, you must have a commercial pilot's license with 165 hours or more (no multi-engine time required); be a U. S. citizen and a high school graduate between the ages of 21 and 28; between 5'7" and 6'4" in height; and able to pass a flight physical without waivers. Applicants with C.A.A. instrument rating or flight engineer examination written portion passed will be accepted through age 29; with both, through 30. Successful applicants attend United's Flight Training Center at Denver and receive pay while training.

Excellent pay . . . you get $465 a month on assignment to line, and from then on, your pay increases at regular intervals.

United Air Lines offers security, too, as well as good pay and rapid advancement. You enjoy a broad insurance program, retirement income plan and many other generous benefits.

To get a booklet giving you all the details about your career opportunities with United Air Lines, simply fill in the coupon and mail. Remember, even if you are not immediately available, United's continuing growth will maintain the need for qualified men for years to come. Get the booklet and plan your future now!

C. M. Urbach, Supt. of Placement
UNITED AIR LINES
Operating Base, Dept. Avia. 10
Stapleton Airfield, Denver, Colorado

Please send me your booklet that tells me how I can become a Flight Officer with United Air Lines.

Name_____

Address_____

City_____ Zone___ State____

Co-Pilot Mechanic

Requires A & E commercial multi engine and extensive D18-S mechanical experience. Aircraft based on Long Island.

P-7899, Aviation Week
330 W. 42 St., New York 36, N. Y.

SUPERINTENDENT MACHINE SHOP

Chance Vought Aircraft has an opening for an experienced Machine Shop Superintendent to assume responsibility for the organization, administration and supervision of the Machine Shop. He will be responsible for the maintenance of production schedules, adherence to quality and cost standards and the efficient use of equipment and personnel. This machine shop of 500 employees includes a wide variety of machine tools such as mills, drill presses, lathes, hones, grinders, boring and welding machines.

The man that we are seeking should have from ten to fifteen years of experience, a considerable part of which should have been spent in aircraft or engine machine shops. He should be experienced in directing a machine shop handling a wide variety of items of a specialty machining nature coincident with the problems of a relatively low volume of production. Personal expense-paid interviews will be arranged for qualified applicants submitting a resume to:

G. H. Orgelman
SUPERVISOR SALARY EMPLOYMENT

CHANCE VOUGHT AIRCRAFT
INCORPORATED

P. O. Box 5907
Dallas, Texas

LOCKHEED AIRCRAFT CORPORATION

Georgia Division
Has immediate openings for

FLIGHT TEST INSTRUMENTATION TECHNICIANS

Minimum 1 year aircraft experience required with experience in the use of one or more of the following:

1. Recording Oscillographs
2. Recording Potentiometers
3. Oscilloscopes
4. Telemetering Equipment
5. Instrument Repair Equipment
6. Strain Gauge Application

Write in complete confidence
Dept. FI-1017

LOCKHEED AIRCRAFT CORPORATION
761 Peachtree St., N.E.
Atlanta, Georgia

ENGINEERS

...work on **JET VTO** at **RYAN**

The development of the dramatic new jet-powered VTO airplane is one of the many exciting opportunities which await you at Ryan—situated in sunny Southern California. All inquiries to the Administrative Engineer are strictly confidential.

OPPORTUNITIES FOR:
Flight Test Engineers
Flight Test Analysts
Electronics Engineers
Systems Analysts
Engineering Designers
Aerodynamicists
Thermodynamicists

RYAN
AERONAUTICAL COMPANY
San Diego 12, California

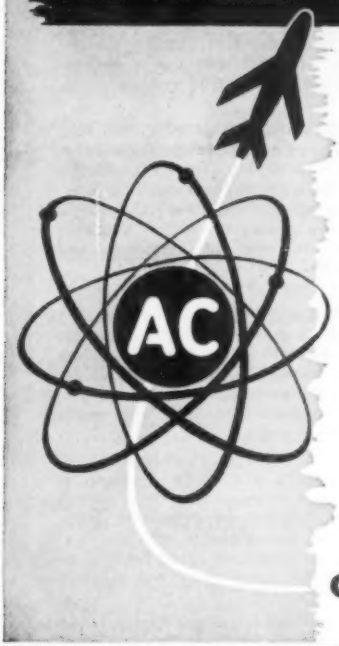
SKILLED

PILOTS

AVAILABLE
No Fee to Employers
PILOTS EMPLOYMENT AGENCY
Teterboro (N. J.) Airport
Hasbrouck Heights - 8-1214

ENGINEERS and DESIGNERS NEEDED

for: MISSILE GUIDANCE SYSTEMS · BOMBING NAVIGATIONAL COMPUTER SYSTEMS · NEW CIVIL AVIATION PRODUCTS · JET AND TURBO-PROP ENGINE CONTROLS · AIRBORNE FIRE CONTROLS



GM CAREER OPPORTUNITIES IN

Systems Engineering and Analysis
Experimental Engineering
Development Engineering
Project Coordination
Design Engineering
Product Engineering
Product Evaluation
Field Engineering

AND WE ALSO NEED:

DESIGNERS • CHECKERS • LAYOUT MEN

Positions Are Permanent — Excellent Advancement Opportunities

Every inquiry treated confidentially and given immediate attention and personal reply.

WRITE TODAY FOR EMPLOYMENT APPLICATION

Mr. Louis R. Berks
Supervisor of Employment

AC SPARK PLUG DIVISION
THE ELECTRONICS DIVISION

GENERAL MOTORS CORPORATION
Milwaukee 2, Wisconsin

NUCLEAR AIRCRAFT POWERPLANT CONTROLS

ENGINEER

This is an unusual opportunity for a Project Engineer who can assume full responsibility for developing controls for a nuclear-powered aircraft engine.

To qualify, you must have 10 to 15 years of pertinent experience. This must include 5 to 7 years' development or analytical work on aircraft powerplant control systems.

At least a B.S. degree is required from an accredited college. Degree must be in Mechanical, Electrical or Aeronautical Engineering.

The man selected will have unequalled facilities at his disposal, for this opening is in the engineering department of Pratt & Whitney Aircraft — world's largest designer and builder of aircraft engines.

Attractive salary and employee benefits. Good schools and excellent living conditions in pleasant upper Connecticut.

Please send complete resume covering education, experience and accomplishments to Employment Supervisor.

PRATT & WHITNEY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORP.
EAST HARTFORD 8, CONNECTICUT

LOCKHEED AIRCRAFT CORPORATION
GEORGIA DIVISION

Has immediate openings for

MATERIALS & PROCESSES ENGINEERS

Minimum 5 years experience in aircraft or allied fields in fabrication, design and materials specification preparation and revisions. Engineering degree required. Work involves contacts with Engineering and Manufacturing personnel. Special consideration given to applicants with nuclear experience.

PRODUCTION DESIGN ENGINEERS

Minimum 10 years experience in aircraft or allied fields of design and fabrication of parts and equipment with emphasis on cost reduction. Work includes review and approval, for producibility, of project drawings and contacts with Manufacturing personnel on fabrication and assembly problems. Special consideration given to applicants with practical experience on nuclear projects.

Write in complete confidence
Dept. MP-1017
761 Peachtree St., N.E.
Atlanta, Georgia

LOCKHEED AIRCRAFT CORPORATION

RESEARCH PROJECTS in the SUPERSONIC AND HYPERSONIC RANGE

One of the nation's leading organizations in the field of aeronautical research, the Cornell Aeronautical Laoratory, is currently engaged in extensive investigation of the problems associated with flight at supersonic and hypersonic speeds. As these programs develop, opportunities become available to technically competent men to join our staff.

Two openings are described below. If you are interested in receiving more information about these specific assignments, or if you would like to inquire about other possibilities of employment, we shall be pleased to hear from you.

STRUCTURAL PROBLEMS CAUSED BY AERODYNAMIC HEATING

A major problem in the design of vehicles that will travel at the very high speeds of hypersonic flight is the prediction of their structural integrity under the high heat loading conditions to which they will be subjected. Analytical and experimental research is underway at Cornell aimed at obtaining a fuller understanding of this "Thermal Barrier" and the structural problems associated with it. Men selected for assignment on the structural phase of the program will work closely with a group that is making major contributions to the store of available data on hypersonic flow. At least five years experience in the field of structures is desired.

STRESS AND VIBRATION ANALYSIS

The Laboratory has recently developed and installed a new experimental apparatus for use in our program of supersonic propeller blade research. We are seeking young engineers with good backgrounds in either theoretical or experimental stress analysis for assignments in this project.

CORNELL AERONAUTICAL LABORATORY, INC.

BUFFALO 21, NEW YORK

ENGINEERS

ROCKET ENGINE CAREERS at NORTH AMERICAN AVIATION

The leader in large liquid Rocket Engine Design, Development and Test.

★ ★ ★

CAREERS in ROCKET ENGINE DEVELOPMENT DESIGN & TEST at the PROPULSION CENTER.

DESIGN & DEVELOPMT ENGRS. Mechanical, Chemical, Electrical, Standards, Structural: For Engine Systems Design and Development—Turbine, Pump and Combustion Device experience preferred.

DYNAMICS ENGINEERS
To analyze Rocket Engine Control Systems utilizing Electronic Analog and Digital Computers. B.S., M.E., or BSEE necessary. Prefer graduate degree. Experience in Servomechanisms, Systems Analysis desired.

COMPUTER APPLICATION ENGR.
Application of Automatic Computers to investigate new methods of Numerical Analysis.

ENGINEERING DRAWINGS CHECKERS, Experienced.

TECHNICAL WRITERS, Experienced Career Jobs.

TEST ENGINEERS
Exp. on engine systems, combustion devices, turbines and pumps, engine instrumentation.

EQUIPT. DESIGN ENGINEERS
Electrical, Mechanical, Structural.

ELECTRONICS TECHNICIANS
Experienced in Instrumentation and Controls.

CONTACT
BOX A-P1

ENGINEERING PERSONNEL
Propulsion Center
Corner Deering & Gault
CANOGA PARK, CALIF.

NORTH AMERICAN AVIATION

ENGINEERS

OPPORTUNITIES IN DESIGN & DEVELOPMENT

SENIOR ENGINEERS For gyro system development projects, and electrical engineers with experience in design and development of circuitry for airborne gyro mechanisms, servo mechanisms and their related systems.

ELECTRONICS ENGINEERS To work on autopilot systems development & design or investigations, evaluation and testing of systems involving interacting servo loops, servo sub-systems, circuitry including audio frequency amplifiers, magnetic amplifiers, and switching systems.

DESIGN ENGINEERS For design and layout of gyro instrument components for aircraft flight control systems. Will consider top-grade machine designers experienced on intricate precision mechanisms with engineering degree.

ENGINEERS AIR DATA Development engineers for master air data systems to be designed specifically for inputs. Requires knowledge of altitude, altitude rate, mach, air speed censors and instrument servo theory and practice.

We are located in Grand Rapids, Michigan, a good clean & modern city of 200,000 where recreational & cultural opportunities are the finest.

Competitive salaries. Generous moving allowance. All replies held confidential.

Interviews arranged at company expense with selected applicants.

Send complete resumes to:

Personnel Manager

LEAR, INC.
110 Ionia Ave. N. W.
Grand Rapids, Mich.

AIRCRAFT GAS TURBINE TEST ENGINEER

New Gas Turbine Laboratory located on Lake Erie near Cleveland has opening for experienced aircraft gas turbine test engineer.

Position requires engineer capable of assuming responsibility for planning and coordinating a variety of test programs from inception to completion.

B.S. or M.S in Mechancial or Aeronautical Engineering from accredited college with 2—4 years experience in gas turbine or related test engineering.

Submit complete resume to:

TECHNICAL PLACEMENT
Thompson Products, Inc.
23555 Euclid Avenue
Cleveland 17, Ohio

TECHNICAL REPRESENTATIVES

LEAR, INC. is expanding its top notch Field Service organization to keep pace with increasingly widespread military acceptance of LEAR flight control systems and flight reference systems.

Attractive salary, liberal expense arrangements. Assignments may require travel or residence at assigned stations. Company orientation prior to assignment.

Qualifications include:

1. **E. E. Degree or equivalent.**
2. **Knowledge of servomechanisms, gyros, electronics.**
3. **Tech. Rep. experience.**
4. **Must be U. S. Citizen.**

To apply, send resume to:
Field Service Manager

LEAR, INC.
110 Ionia Ave., N. W.
Grand Rapids 2, Mich.

ENGINEERS

DESIGNERS

Investigate Opportunities at **ERCO** DIVISION
ACF INDUSTRIES, INC.

DRAFTSMEN

ERCO Engineers have built a record of continuous progress and growth for themselves and for the Company for a quarter of a century . . . growth in physical plant, personnel, number and diversity of products and services.

Today this growth continues and we are constantly on the alert for new men to add fresh impetus to that progress . . . paying top salaries to capable people.

Your work will be interesting and stimulating . . . it might include electronic flight simulators, machine tools, guided missiles, or a variety of specialized electronic devices.

You can choose a home from a number of fine nearby residential areas convenient to both shopping centers and plant . . . and you can further your education at the many nearby Universities . . . you can enjoy suburban living and be within easy reach of the cultural advantages of the Nation's Capital.

ERCO now needs Electronic Engineers (all levels with some overseas positions available), Aerodynamicists, Analog Computer Engineers, Mechanical Design Engineers, and supporting personnel. Send resume or request for additional information to:

ERCO DIVISION
ACF INDUSTRIES, INC.
RIVERDALE, MARYLAND

BELL *Aircraft* CORP.

TEXAS DIVISION

Openings for:

ENGINEERS:

MECHANICAL
ELECTRICAL
AERODYNAMICISTS
DYNAMICISTS
WEIGHTS
SERVO
STRESS

ENGINEERING PERSONNEL
BELL AIRCRAFT CORP.
FORT WORTH, TEXAS

LOCKHEED AIRCRAFT CORPORATION
GEORGIA DIVISION

Has openings in the following classifications:

FIELD SERVICE REPRESENTATIVE

An opportunity awaits you in Field Service if you are under 40 years of age with previous field service experience and are willing to travel. Please include a recent photograph with your resume.

SENIOR PRICE ESTIMATOR

Requires ability to read and visualize shop operations from blueprints and a working knowledge of accounting statistics and material procurement.

Write in complete confidence

Dept. FS-1017
761 Peachtree St., N.E.
Atlanta, Georgia

LOCKHEED
AIRCRAFT CORPORATION

EMPLOYMENT OPPORTUNITIES

(Continued from pages 121-127)

SEARCHLIGHT SECTION

(Continued on pages 129 & 130)

ENGINEER
M. E. or E. E.
DIGITAL COMPUTER DEVELOPMENT

Excellent opportunity to join an expanding, stable company, with an outstanding position in the precision electronic control industry.

Opening now available for an engineer able to assume responsibility for the development of complete systems for fire control and guidance, or major portions of such systems. Work will include research and development in the field of complex analog or digital computers.

A degree in electrical or mechanical engineering is required or the equivalent in experience. Send resume in confidence to:

Technical Personnel Dept. 2-500

ARMA

Division American Bosch Arma Corp.
Roosevelt Field, Garden City
Long Island, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITION VACANT

Chief Engineer: Exceptional position open for graduate mechanical engineer, age 35-45, as head of an engineering department for company in compressed gas industry. Five to ten years experience required in product design and product engineering involving manufacture of pressure regulating equipment and flow control apparatus. Previous experience in organizing and managing an engineering department is preferred. This is a top position with a long established firm in the mid-west manufacturing and distributing on a national basis products used by hospitals and the aviation industry. Salary open. Will pay interview expenses. Please state education, positions held, availability and salary desired. Replies confidential. Box P-7969, Aviation Week.

SELLING OPPORTUNITY OFFERED

Sales Engineers Wanted—Excellent opportunities for several engineers with well established East Coast instrument manufacturer now expanding its line of aviation products which includes electronic and electro-mechanical components for jet engines and guided missiles. Electrical engineering background essential. Must have established contacts with the aircraft industry. Openings in Los Angeles, Dallas, and East Coast areas. Generous company paid benefits include hospitalization, pension, insurance, and vacation plans. RW-7898, Aviation Week.

POSITIONS WANTED

Pilot: Age 24, commercial, instrument, link rating, 3 years college, USAF senior instrument flight trainer instructor, desire executive pilot position. Resume on request. Prefer Miami Area. PW-7962, Aviation Week.

Copilot wanted for corporation owned twin beech bases in SE. Desire ATR or experienced instrument pilot under 35 yrs. PW-7977, Aviation Week.

Pilot ATR—4000 hrs. 1st pilot multi engine. Scheduled air line experience, executive experience. College equivalent education. Now crop dusting. Prefer corporation type flying. 2309 Longstreet Drive, Memphis, Tenn.

MODERNIZE YOUR DC-3 ...NOW!

add greater
safety • speed • comfort

With These Soundly Engineered and Flight Proven Modifications

- **200 MPH PLUS CRUISING SPEED**
  Wright R-1820-72 AM1 engines and Hamilton Standard 23E50/6477A-0 paddle blade propellers...high performance, light weight 1350 horsepower engines. Or, P&W R-1830-75 or -94 engines may be used.
- **26,900 POUND GROSS TAKE-OFF WEIGHT**
  Heavy landing gear, rudder tab modifications and 1350 horsepower engines give you DC-3 extended fuel range, higher pay loads—greater safety.
- **200,000 BTU TAIL INSTALLATION HEATING SYSTEM**
  Janitrol unit with automatic heat regulators for cabin and cockpit. Allows extra room for additional radio and electrical installations in cockpit.

TODAY!... Call, write, or wire:
JOHN GRIFFIN, Customer Service Manager
for your DC-3's work-schedule dates.
Phone 64-0611

L. B. Smith AIRCRAFT CORPORATION
INTERNATIONAL AIRPORT, MIAMI 48, FLORIDA

2 C-46F Type Aircraft

Available for long term lease or lease purchase arrangement.

Zero time, passenger or freight, Hamilton Standard props, full de-icing equipment, modified to 48,000 lbs. gross take-off weight.

International Aircraft Maintenance Co.
Lockheed Air Terminal, Burbank, Calif.
STanley 7-5378

Immediate Delivery

We stock, overhaul and install

WRIGHT R1820 —202, —56, —72
PRATT & WHITNEY R1830 —75, —92, —94
R2000 R1340 R985
and our most popular DC3 engine R1830 - SUPER - 92

ENGINE WORKS
Lambert Field Inc. St. Louis, Mo.

Deal Directly with Owner

C-18S BEECHCRAFT FOR LEASE

No deposit required—no long-term contract.

- Nice airplane
- Well equipped radio
- Auto pilot
- Good interior
- De-icing equipment
- 50 gal. nose tank

$800 monthly. Fly all you like. Aircraft hull insurance included if desired. aircraft available for outright purchase

TRADE-AYER COMPANY
Linden Airport Linden, N. J.
Hunter 6-7690

C-47 - DC-3C DOUGLAS AIRCRAFT

26 and 28 airline passenger aircraft for immediate delivery on lease-purchase, long term payment purchase or straight cash purchase at below market price. Aircraft in excellent condition having airstair door, outside baggage compartment.

Call, write or wire . . . .

WILLIAM C. WOLD ASSOCIATES
516 Fifth Ave. New York 36, N. Y.
Cable: BILLWOLD Tel. MUrray Hill 7-2050

AIRCRAFT PARTS!

ALL UNUSED! Immediate delivery from one of the world's largest stocks of aircraft parts!

AIR CONDITIONING

Pieces		
6	83A94	Surface Combustion—Heater
2	C97A49	Surface Combustion—Heater
7	C97-A28	Surface Combustion—Heater
185	921-B	Stewart Warner—Heater
9	CO50A	Air Engineering—Blower
3	A28A8640	Joy—Blower
5	AFB129-100	Hoover—Blower
18	4582-A-A-6G	Dynamic Air Engineer—Blower
358	23010N	Thomas A. Edison—Thermostat
10	3094	Barber Colman—Thermostat
1	AR5519	Thermostat
10	FYLD2516	Thermostat
35	LD10W	Thermostat
126	17322-2	Fenwal—Thermoswitch
▶ 4	184230-0	Fenwal—Thermoswitch
20	18522-0	Fenwal—Thermoswitch
3	17322-1	Fenwal—Thermoswitch
261	1033-4E1	White Rodgers—Heat Control Switch
22	A55A00	Surface Combustion—Heater Ignition Unit
12	468361	Vapor Car Heating—Temperature Compensator
36	9804B	Vapor Car Heating—Control Box
49	715E	Fulton Syphon—Temperature Control
1	O3C-10	Surface Combustion—Heater Ignition Unit
22	17343-6	Thermoswitch
22	18422-0	Fenwal—Thermostat
13	954-A	Thermoswitch
3	PG208-AS13	Air Ram Switch
9	4510-1	Aerotec—Air Vent
35	SW470544A	Stewart Warner—Valve
18	SW472083	Stewart Warner—Heat Exchanger
2	G475015	Stewart Warner—Valve
1	B1075	Airesearch—Turbine Heat Exchanger
4	17320-12	Fenwal—Thermoswitch
4	18423-0	Fenwal—Thermoswitch

VALVES

Pieces		
10	17589-2	Airesearch
4	17837	Airesearch
5	90420-2	Airesearch
8	90420-2-50	Airesearch
17	92980	Airesearch
27	92990	Airesearch
24	10003	Adel
8	12798	Adel
7	12880-2	Adel
10	12880-3	Adel
21	12924-2	Adel
14	13904	Adel
25	13956	Adel
4	17090	Adel
8	20448-2	Adel
125	20501-3	Adel
13	23314-3	Adel
2	24257	Adel
9	A34220	Adel
2	MFC-8-01	Bertea
2	MFC-8-02	Bertea
16	AA11435	Vickers
10	AA11504	Vickers
6	AA13011	Vickers
5	AA13016	Vickers
13	AA13021	Vickers
6	AA13023	Vickers
19	AA14503	Vickers
4	AA14505	Vickers
12	34583	Vickers
8	AA37001	Vickers
1	A380000	Vickers
207	AV 1B 1174	G. E.
8	12782	Saval
81	AA14543	Vickers
54	AA14542	Vickers
3	AA14548	Vickers
498	AA17001A	Vickers
6	TCD 15008	Thompson
6	MD38300	Thompson
141	35801-3	Koehlers
5	14517-2	Adel
1500	AC37D6210	Koehler
3	AN4103-2	Clifford
174	AN5830-1	Whittaker
24	AA31400	Vickers
8	AN6017-1	
32	AN6018-1	
4	AN6200-4A	
27	AN6200-8A	
340	AN6207-8	
9	AN6207-10	
567	AN6207-12	
140	AN6209-4D	
131	AN6209-8	
50	AN6213-2	
2	AN6214-2	
3	AN6245-A4	
14	AN6245-AB4	
3	AN6249-4	
2	AN6277-6	
6	AN6278-4	
5	AN6279-8	
3	AN6280-4	
8	AN6280-6	

ELECTRONICS & INSTRUMENTS

Pieces		
16	30725	Air Tron—Wave Guide
16	30686	Air Tron—Wave Guide
19	753A	Rhodes Lewis—Intervalometer
30	TOE-8A-6P	Bendix—Oscillator
28	TOE-8A-6N	Bendix—Oscillator
16	TOE-8A-2N	Bendix—Oscillator
148	TOL-4A	Bendix—Oscillator
57	T-200	Melpar—Transmitter
73	TTO-1A	Bendix—Position Meter
120	5103112-003	Hayden—Timer
20	TA 12B	Bendix—Transmitter
35	RA 10DB	Bendix—Receiver
4	AN5753-1A	Eclipse—Pioneer—Amplifier
5	T-2100-3A	Kearfott—Directional Gyro
1	XW 8610	Kearfott—Vertical Gyro
79	MT5	—Transformer
139	MT6	—Transformer
12	15701-1A	Eclipse—Pioneer—Controller
47	2548K-6-052	Kollsman—Diff. Pressure Gs.

COMPONENT PARTS

Pieces		
73	1416-12	Eclipse—Starter
100	NEA-3	Eclipse—Generators
150	981280	Kidde—CO^2 Cylinders
407	SF9-LN2	Scintilla—Magneto
29	NEP-2	Eclipse—Aux. Power Unit
16	LER-30D	Eclipse—Aux. Power Unit
419	450	Skinner—Filters
149	10966A	—Dash Unit
34	AN6025-96	Kidde—Fire Extinguisher
99	TCD14900-2A	Thompson—Cock
8	AA16801A	Vickers—Hyd. Transmission
273	AN6220-4	Aeroquip—Coupling
1	B1075	Airesearch—Turbine Heat Exchanger
4	180011-1	Airesearch—Water Separator

ACCUMULATORS

Pieces	Part No.	Manufacture
2	MOD AC450	Aircraft Products
2	S369-50-H2	Sprague
2	S369-100-H2	Sprague
4	Mod R11B	Airborne
50	AN6230-1	Bendix
40	AN6203-3	Bendix
56	AA14002A	Vickers
2	AA14005A	Vickers
11	AA14007A	Vickers
3	AA14008B	Vickers

SWITCHES

Pieces		
26	MS49A	Bendix—Antenna
70	AN3213-1	Scintilla—Ignition
66	M862A	Pollack—Master
148	PG208-AS1	Honeywell—Air Ram
40	PG208-AS7	Honeywell—Air Ram
20	M101B	Aerotec—Pressure
5	M102	Aerotec—Pressure
349	M826	Aerotec Pressure
93	4401W	Aerotec—Fuel
22	417	Meletron—Actuator

TRANSDUCERS

Pieces		
2	46131CN-G-250-20	Giannini
10	47114-D2.0-20	Giannini
2	47114-D4-20	Giannini
2	47132A-2.0-20	Giannini

PROPELLER PARTS

Pieces		
20	72400	Hamilton Standard—Reversing Control
4	X836-1C2-0	Curtis—Blades
25	4350F	Curtis—Blades
76	4350	Curtis—Blades
60	4350F1	Curtis—Blades
1	129945	Curtis—Propeller Assy.

PUMPS

17	AN4014	Erie Meter
5	2P248EB	Pesco
21	2E258SA	Pesco
8	1E 621	Pesco
2	220048-021-01	Pesco
3	141082-22-01	Pesco
120	MF9-713-15H	Vickers
124	PF12-713-25BCE	Vickers
327	PF4-713-20BCE	Vickers
30	MF45-3911-20Z	Vickers
5	67WF300-1	New York Air Brake
2	67WF300	New York Air Brake
6	610-2C	Eclipse
4	5B204A296	General Electric
33	420313	Wright Aero
46	416421	Wright Aero
76	TFD8600	Thompson
7	TFD10700	Thompson
1	TFD11400	Thompson
6	TFD6500	Thompson
2	TFD28000-1	Thompson
107	D12296	Adel
3	20007-5	Adel
1	22407-1	Adel

WRIGHT ENGINES

4 Pcs. 3350-57

268 Pcs. 2600-20

Our catalog of AN hardware will be sent on request. Contact us for your requirements.

COMMERCIAL AIRCRAFT PARTS CO.

4101 CURTIS AVE., BALTIMORE 26, MARYLAND • TELEPHONE: CURTIS 7-3300

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED —RATES— DISPLAYED

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Box Numbers count as one line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

The advertising rate is $18.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns, 30 inches to a page.

Closing Date: 10 days before issue date, subject to space limitations.

(Continued from pages 128 & 129)

WANTED

FOR SALE

Lodestar Parts: Very wide range of new Lodestar spares at attractive prices. Contact Commercial Air Services (PTY) Ltd., P. O. Box 2245, Johannesburg, South Africa. Cables "Comair Johannesburg".

AIRPLANES WANTED
Need 50 Bonanzas, Navions, 180's, 190's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used
Vest Aircraft Co.'s Skyranch
BOX 5306, DENVER 17, COLORADO

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

We Buy DC-3 and C-47
—also components, fuselages, center sections. Prefer runout or needing work, airline, passenger, or cargo, Pratt & Whitney or Wright. State price, time, quantity, type engines.
We are not brokers
REMMERT-WERNER, INC.
Lambert Field St. Louis, Mo.

SPECIAL SERVICES TO THE AVIATION INDUSTRY

AIRCRAFT DEALERS

CONSULT LUND FIRST
when buying or selling
COMMERCIAL AND MILITARY AIRCRAFT, ENGINES, PROPELLERS, ACCESSORIES, INSTRUMENTS, RADIO, SPARE PARTS
With trained technicians and our own inventories we are geared to give you service with SPEED!
BOTH BUYERS AND SELLERS LOOK TO US!
Lund Aviation, inc.
230 Park Ave., N.Y.C. MUrray Hill 9-3620

RENDER A SERVICE?
Write for rates.

OVERHAUL & MAINTENANCE

REMMERT-WERNER, Inc.
Lambert Field St. Louis, Mo.
offer your choice of

1 DAY	2 DAY	3 DAY
100 hour INSPECTIONS	OR	100 hour OVERHAULS
BEECHCRAFT	for DC-3	LODESTAR

PARTS & SUPPLIES

NAVCO INC. Lambert Field St. Louis, Mo PErshing 1-1710
Has all Parts and Supplies for Executive
DC-3 LODESTER BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

"Take a Heading for Reading"
FOR THE BEST
MAINTENANCE - OVERHAUL - MODIFICATION - INSTALLATION
READING AVIATION SERVICE, INC.
MUNICIPAL AIRPORT Phone 8-5255 READING, PENNSYLVANIA

FOR RATES OR INFORMATION

About Classified Advertising,

Contact The McGraw-Hill Office Nearest you.

ATLANTA, 3
1321 Rhodes-Haverty Bldg.
WAlnut 5778
W. LANIER

BOSTON, 16
350 Park Square
HUbard 2-7160
P. McPHERSON

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
H. BOZARTH
W. HIGGENS

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
C. J. LOUGHLIN

DALLAS, 2
Adolphus Tower Bldg., Main & Akard Sts.
PRospect 5064
J. CASH

DETROIT, 26
856 Penobscot Bldg.
WOodward 2-1793
L. SEEGAR

LOS ANGELES, 17
1111 Wilshire Blvd.
MAdison 6-4323
C. F. McREYNOLDS
G. JONES

NEW YORK, 36
330 West 42 St.
LOngacre 4-3000
W. SULLIVAN
D. COSTER
R. LAWLESS

PHILADELPHIA, 3
17th & Sansom St.
RIttenhouse 6-0670
J. WILLIS

ST. LOUIS, 8
3615 Olive St.
LUcas 4867
H. BOZARTH

SAN FRANCISCO, 4
68 Post St.
DOuglas 2-4600
T. E. WYCKOFF

WHAT'S NEW

Telling the Market

Alite sintered metallic oxides, bulletin, Alite Div., U. S. Stoneware Co., Akron 9, Ohio. . . . **"Variation of Load at Yield of Type 304 Stainless Steel Tubing When Held by Crawford Swagelok Tube Fittings,"** charts, Crawford Fitting Co., Cleveland 10, Ohio. . . . **Precision needle rollers,** Catalog No. 61, Kaydon Engineering Corp., Muskegon, Mich.

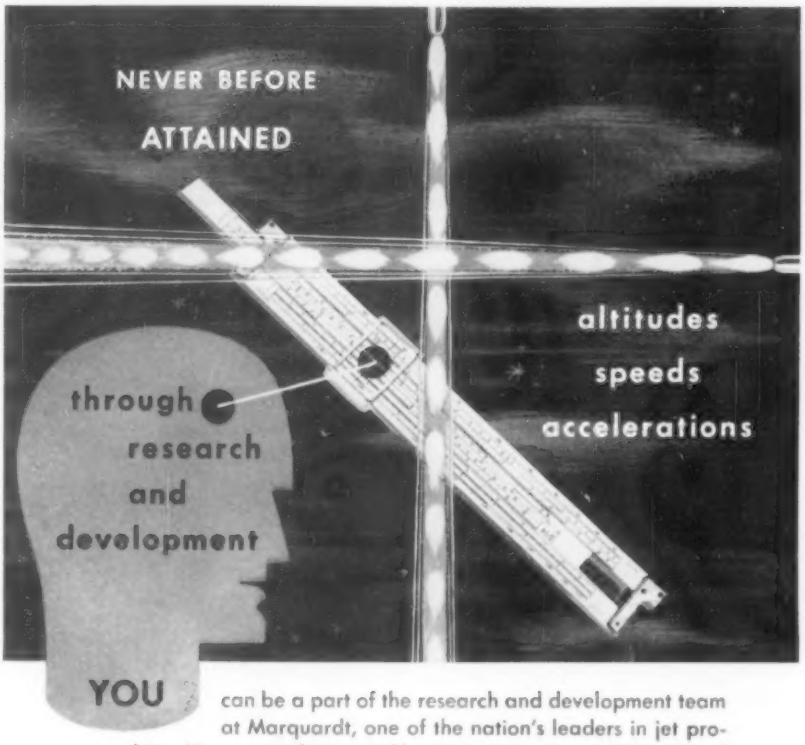
"Copper Base Alloys in Rod Form," catalog, Mueller Brass Co., Port Huron, Mich. . . . **Automation and systems engineering,** Brochure C 901, Dept. HR-26, Barkley Division, Beckman Instruments, Inc., 2200 Wright Ave., Richmond 3, Calif. . . . **Aircraft wire and cable** condensed specifications, bulletin, Electric Auto-Lite Co., Wire & Cable Div., Port Huron, Mich. . . . **Service tips for pyrometer users,** Bulletin F. 7259, Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.

"Controlled-Air-Power Devices," Bulletin ML-3, Bellows Co., 222 W. Market St., Akron, Ohio. . . . **Bellows type expansion joints** and pressurized Hydropads, Catalog No. 52, Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.

Brochure on qualifications, personnel, **equipment and facilities at Inland Testing Laboratories,** 1457 W. Diversey Parkway, Chicago 14, Ill. . . . **Editorial Index of "Planes"** from January 1952 to June 1955, Aircraft Industries Assn., 610 Shoreham Bldg., Washington 5, D. C.

Production processing and service facilities, booklet, Allied Products Div., Hamilton Watch Co., Lancaster, Pa. . . . **Gage brochure,** Freeland Gauge Co., 9940 Freeland Ave., Detroit 27, Mich. . . . **Silicone-rubber insulating system** for utilization in motor and generator stator windings, leaflet, Allis-Chalmers Manufacturing Co., 1234 S. 70 St., Milwaukee, Wis.

Brazing and processing stainless steel, brochure; **Nicrobraz,** a heat- and corrosion-resistant alloy for brazing stainless steel, data file; Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. . . . Properties, characteristics and **applications of aluminum alloys,** brochure, Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, N. Y. . . . **Precision tools** available for multiple-spindle ma-



can be a part of the research and development team at Marquardt, one of the nation's leaders in jet propulsion. You are not hampered by restrictions necessarily imposed by larger, more complex organizations . . . at Marquardt, the sky has *no* limit! If you're eager to begin creative *thinking* and *doing* . . . if you want to start building the foundations for your castles in the sky . . . then Marquardt is the place for you!

You will enjoy living in climate-perfect San Fernando Valley—you will enjoy working with and for people who have their eyes on the skies of the future, where altitudes, speeds and acceleration are limitless!

For information regarding employment, write

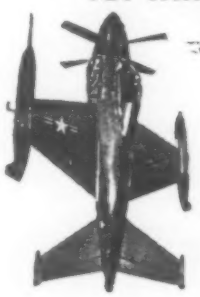
marquardt AIRCRAFT CO.

INDUSTRIAL RELATIONS DEPARTMENT
ATTENTION: PROFESSIONAL PERSONNEL
16555 SATICOY STREET • VAN NUYS, CALIFORNIA

THE WEST'S LARGEST JET ENGINE RESEARCH AND DEVELOPMENT CENTER

CONSTANTLY GROWING THROUGH BETTER SERVICE

electrical components & sub-assemblies for military aircraft & missiles



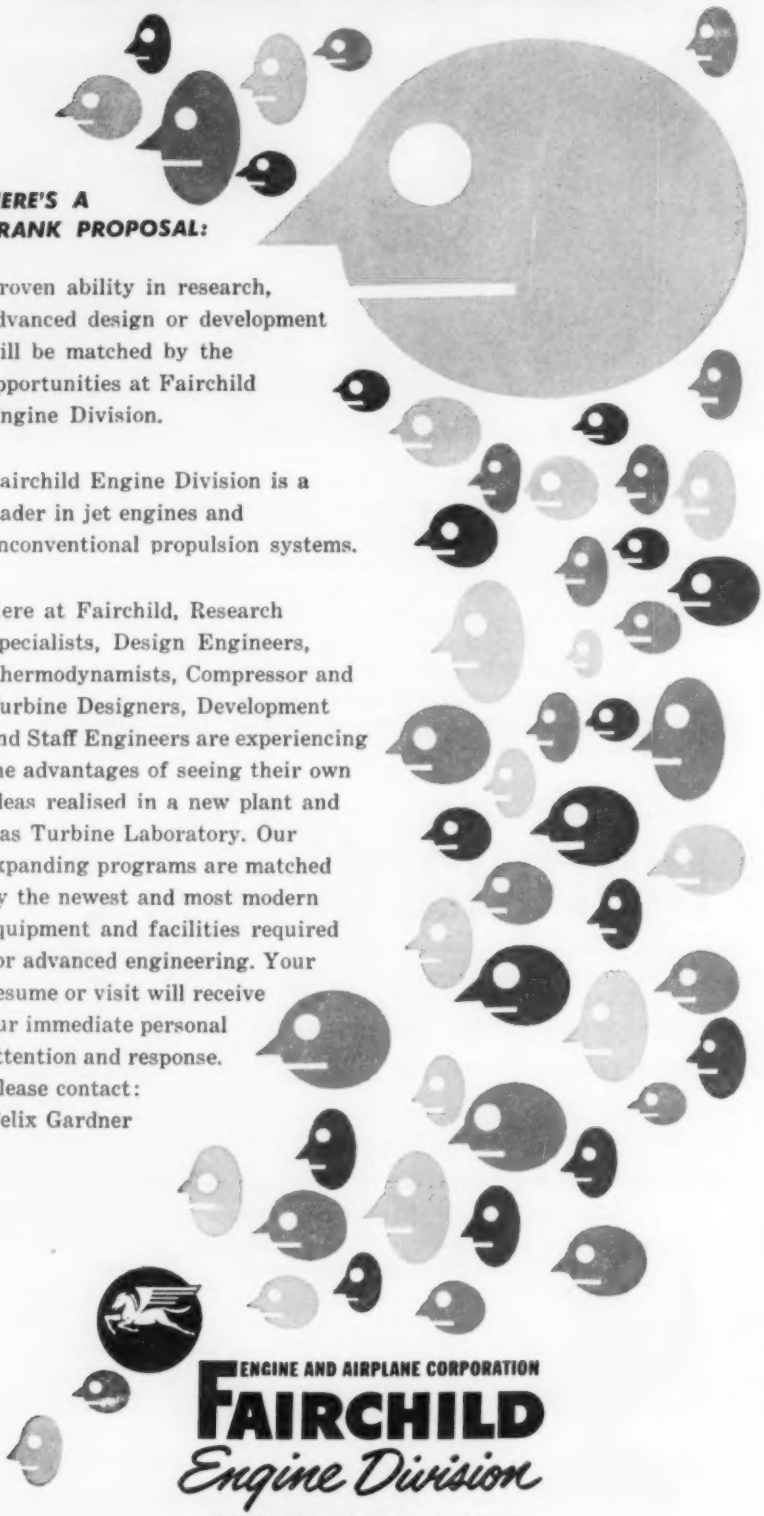
We are currently producing parts for numerous military aircraft and missiles; also parts and sub-assemblies in many other fields. For top quality and best prices—

CONTACT

All Types Harnesses & Assemblies
Aircraft Component Parts
Co-Axial Cable Assemblies
Shielded Cables
Junction Boxes
Thermocouples
Electronic Control Boxes
Test Equipment

bernco engineering corporation
5230 W. 10th St., Indianapolis, Ind.

To the one engineer in 100 who is planning to make a change:



HERE'S A FRANK PROPOSAL:

Proven ability in research, advanced design or development will be matched by the opportunities at Fairchild Engine Division.

Fairchild Engine Division is a ·ader in jet engines and nconventional propulsion systems.

Here at Fairchild, Research Specialists, Design Engineers, Thermodynamists, Compressor and Turbine Designers, Development and Staff Engineers are experiencing the advantages of seeing their own ideas realised in a new plant and Gas Turbine Laboratory. Our expanding programs are matched by the newest and most modern equipment and facilities required for advanced engineering. Your resume or visit will receive our immediate personal attention and response. Please contact: Felix Gardner

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Engine Division
DEER PARK, LONG ISLAND, NEW YORK

chines, Bulletin 6-50, Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill. . . . **Binotrol punched tape control system,** brochure, Barnes Engineering Co., 30 Commerce Road, Stamford, Conn.

Installation, performance and maintenance of **Dynamatic electronic control,** Bulletin EC-1, Dynamatic Div., Eaton Manufacturing Co., Kenosha, Wis. . . . **Aerial photographic equipment,** data sheets, Gordon Enterprises, North Hollywood, Calif. . . . **Modernized gap frame double crank presses,** Bulletin 65C, Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.

How spectrophotometry is solving metals analyses problems, Data Sheets DU-36-M **(lead determinations)** and DU-39-M **(tungsten assay),** Beckman Div., Beckman Instruments, Inc., Fullerton, Calif. . . . **Aluminum trucks,** folder, Magnesium Company of America, Tobey Aluminum Div., East Chicago, Ind.

Precision, miniature and snap-acting switches, catalog, Unimax Div., W. L. Maxson Corp., 460 W. 34 St., New York 1, N. Y. . . . **Self-aligning spherical bearings** and rod ends, catalog, Kahr Bearing Div., Aetna Steel Products Corp., 812 S. Flower St., Burbank, Calif. . . . **Industrial Enclosed Switches,** Catalog 83, Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Publications Received

• **Airman at Yalta**—By Gen. Laurence S. Kuter—Pub. by Little, Brown & Co., 34 Beacon St., Boston 6, Mass. $3.00; 180 pp. An airman's account of the Yalta conferences.

• **'Sound Barrier'**—by Neville Duke and Edward Lanchbery—Pub. by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $4.75; 129 pp. Revised edition of a history of the evolution of highspeed flight.

• **Fifth Symposium (International) on Combustion**—Pub. for Combustion Institute under the auspices of Standing Committee on Combustion Symposia—Pub. by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $15.00; 802 pp. Outstanding papers presented at this symposium held in 1954 at the University of Pittsburgh.

• **The First Five Million Miles**—by Byron Moore—Pub. by Harper & Brothers, 49 East 33rd St., New York 16, N. Y. $3.75; 276 pp. An airline captain tells the story of his 30 years of flying.

• **An Introduction to the Theory of Aeroelasticity**—GALCIT Aeronautical Series—By Y. C. Fung—Pub. by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.50; 490 pp. Fundamental principles of the theory of aeroelasticity.

The Wild Blue Yonder is Often RED HOT!

MIL-W-7139A is the standard for **Warren Wire's WW400** . . . super-tough cable made to stand up under the terrific punishment of both ultra-high and extremely-low temperatures experienced by jets, guided missiles and fast-cruising air liners.

Warren Wire's WW400 is the toughest, most heat- and abrasion-resistant low tension aircraft cable. With its silver plated copper heart protected by impermeable Teflon® treated glass and braid, **WW400** meets the rigid military specifications of **MIL-W-7139A** . . . withstanding temperatures ranging from far above +400°F to well below —85°F. In addition, this superb cable is impervious to all fuels, chemicals and solvents.

TO COMPLETE YOUR CLASS H INSULATION SYSTEM:
TEFLON COATED GLASS FABRICS AND YARN • WARRENITE AND GLASTITE TEFLON LEAD WIRE MADE TO MIL W 16878A • TEFLON MAGNET WIRE

WW

WARREN WIRE COMPANY

Plant and Main Office: POWNAL, VERMONT
NEW YORK • SYRACUSE • NEW HAVEN • PHILADELPHIA
PITTSBURGH • CINCINNATI • CLEVELAND* • DETROIT • CHICAGO*
ST. LOUIS* • ST. PAUL • LOS ANGELES* • SAN FRANCISCO
Manufacturers of Plain Enamel, Nylonel, Formvar, Nyform, Bondvar, Silicone and Teflon Magnet Wire . . . Teflon Hook-up and Lead Wire . . . Tinned, Bare and Bunched Copper Wire.

*Office and Warehouse

®DuPont

SAMPLES AND SPECIFICATIONS: Air Frame, Component and Guided Missile Manufacturers write today for samples and detailed information on how WW400 fits your specific needs.

New plant for MENASCO

Expanded facilities for meeting the challenge of consistently better LANDING GEAR AND GUIDED MISSILE COMPONENTS

Pictured above is the new $5,000,000 Texas plant of Menasco Manufacturing Company, scheduled for completion early in 1956. Centrally located between Fort Worth and Dallas, about two miles from Amon Carter Field, the initial 100,000 square-foot structure will house 500 employees and a completely integrated manufacturing system for the design and production of aircraft landing gear and guided missile components. The 42-acre site will allow further facility expansion, as required, to meet Menasco's growing production demands. Like Menasco's Burbank, California, facility, the new plant will offer the benefits of the years of aviation experience, the highest engineering skills, and unsurpassed manufacturing techniques that have always characterized Menasco's services to the nation's leading airframe manufacturers.

Specialists in aircraft landing gear

menasco manufacturing company

805 S. SAN FERNANDO BOULEVARD, BURBANK, CALIFORNIA

Slim Profit Margins Plague Airlines

Sir William Hildred tells IATA meeting of traffic growth, increases in costs, postal rate problems.

By Craig Lewis

New York—Traffic on the international air transport system is growing at a healthy rate, but small operating profits are still a major airline worry, Sir William P. Hildred, Director General of the International Air Transport Assn., said here today.

Reporting to the Tenth Anniversary General Meeting of IATA, Sir William said that, while traffic showed substantial increases in all categories, the IATA airlines' operating margin was about 3%. Operating profit for all the world scheduled airlines was about $71,000,000 last year—the level it has maintained since 1952.

In his report, Sir William criticized world postal administrations for cutting revenues by forcing the airlines to accept rate cuts up to 30%, then failing to pass the savings on to the public.

The IATA Director General forecast continued gains in passenger and cargo traffic, with passenger development tied to promotion of tourist operations.

Capacity Gains 15%

Last year, IATA airlines flew more than 1.25 billion aircraft-miles and carried 59 million passengers over 32.5 billion passenger-miles. Cargo traffic was 682 million ton-miles; mail traffic 198 million ton-miles. These figures show increases of 14% in passenger traffic, 8% in cargo and 18% in mail.

At the end of 1954, the member airlines were operating about 2,500 aircraft, 1,100 four-engine and 1,400 twin-engine.

The overall total increased by 25 aircraft, but the four-engine total increased 100 planes. The result is a 1% increase in operating units and a 15% increase in capacity.

IATA experts report that ton-mile cost is generally stationary, the result of two opposite trends. While costs continue to rise, capacity continues to increase, and the cost can be spread over a larger base. Sir William calls this balance "precarious" since some costs rise with output and there are limits to efficiency improvements.

This precarious balance may continue for a few years if traffic gains are maintained and no unforeseen demands are made on the carriers, according to the Director General.

Sir William points out that the industry has to live on expansion, and that capital expenditure on long-haul aircraft was $200 million last year. He predicts that the same amount will be spent this year.

Narrow Margins

With such expenses, the airlines can muster an operating margin of only 3% —$71 million. Sir William compares this profit of world aviation with the $67 million profit of U. S. domestic aviation and reports an operating profit of $4 million for international aviation —¼ of 1%.

In his forecast, Sir William said that the airlines are hampered in their development by having to work with narrow margins and by requiring subsidies. These factors limit airline freedom as business enterprises to handle their development. As costs are kept down, the fare level is also kept down, according to Sir William, because "A man must have bread even if you double the price of the loaf. It is not so with air travel, and wo allow for that at all times."

The Director General described tourist operations as the key to the future of passenger traffic. He said this has been "triumphantly demonstrated" on the North Atlantic where traffic has increased "by leaps and bounds" since tourist service was introduced. Of last year's 550,000 North Atlantic passengers, 70% flew tourist, and there were 50,000 more tourist passengers than the total of all passengers in 1951.

Cargo Education

"Undoubtedly," said Sir William, "a certain percentage of these passengers would have travelled had tourist services not been available, but since it is our aim to bring air travel to anyone who can afford it, we should not concentrate on the question of diversion and look instead at the overall financial results.

"By those standards the results are good, and there is no doubt that passenger revenue is currently much higher than it would ever have been had no tourist services been introduced," he said.

The development of air cargo is viewed by Sir William as largely a case of producing a simple, economical rate schedule and then educating the shipping public to the many advantages of shipping by air. He said the carriers expect to tap a mass cargo market as soon as they can solve these problems.

SIR WILLIAM P. HILDRED

The prospect for increases in mail revenues are not good, according to the report. The airlines have been forced to accept substantial rate cuts, and mail volume hasn't developed sufficiently to make up the difference.

Sir William points out that while the volume of foreign mail carried by U. S. flag carriers increased 15% in 1954, foreign mail revenues dropped 1%.

Postal Rate Problems

He also expressed disappointment that the postal administrations of the various nations have generally failed to pass savings from airline rate cuts along to the public in the form of reduced postal rates. It was hoped that such reductions would increase air mail traffic, he said.

Sir William called for a firm stand by the airlines against any attempt to further reduce rates at the 1957 Postal Congress at Ottawa. He said airlines are asking for a fair deal, but they doubt they will get it and, as public servants, are unable to do anything about it. If the governments concerned prefer a postal profit and an airline deficit, there is nothing the carriers can do about it, he said.

"If, however, governments are interested in an accurate assessment of the economic cost of each sector of their economy, they might give the matter study at the highest level in order to maintain a healthy balance between interests of the airlines and interests of postal authorities—bearing in mind that

Trans-Canada and Capital report remarkable traffic increases with Vickers VISCOUNTS

Wherever the Viscount flies... traffic figures rise! The latest dramatic proof of this statement is to be found in the recent records of Trans-Canada Air Lines and Capital Airlines.

TCA put Viscounts into service last April and increased traffic 22.5% over a major route in a five-month period. Capital inaugurated Viscount service on its Washington-Chicago route in July. Already they report that the Viscount is carrying more passengers *in both directions* than any other airliner.

The preference air travelers everywhere show for the Viscount is securely rooted in advantages they can see, feel and enjoy. The Viscount has reduced flight times by as much as 30%. It is almost completely free from fatiguing engine noise and vibration providing an atmosphere of unique quiet and comfort.

The turbo-prop Vickers Viscount has proved its mettle under a wide variety of operating conditions. The results are always the same—profits, traffic and load factors *up;* operating costs *down.*

Behind the Viscount stand the great name and service organization of the Vickers Group—internationally famous as makers of aircraft, ships, industrial machinery and precision equipment.

VICKERS

VISCOUNT

built by VICKERS-ARMSTRONGS
powered by ROLLS-ROYCE

VICKERS-ARMSTRONGS (AIRCRAFT) LTD.
Weybridge, England

United States Representative: Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N. Y.

it is, after all, the interest of their public, their taxpayers, which they should try to protect," Sir William said.

In reference to the relationship between governments and airline rates and costs, the Director General observed that practically every time a government takes an interest in the airline business in general, the result is increased costs or reduced revenues. Government restrictions and requirements for forms and information, and government tinkering with the IATA rate structure inevitably result in disruption and in increased costs to the industry, he said.

Subsidy and Supervision

Sir William told the delegates he would like to see subsidy regarded and discussed with a better sense of proportion. He points out that many other industries are subsidized by their governments to a greater extent than the airlines. The subsidy for American international operations for the current fiscal year is quoted by Sir William at $30 million, a third of the amount Americans are spending for comic books and two thirds of the U.S. government expenditure in 1954 for peanut price supports. France spends less to support air transport than the $60 million annual subsidy for the growing of beet root.

Airlines not only get government aid but are subject to "the scrutiny of layer upon layer of government experts," Sir William said. He pointed out that airline practices are closely watched and regulated, and that such supervision is not conducive to the sane development of an industry.

"Unfortunately, the close regulation and scrutiny to which the airline is subjected does not produce among its scrutineers a realization of what the industry really needs," he told the meeting.

The rising trend toward user charges for airports and navigational facilities was criticized by the Director General in his report. He said that there is currently too much preoccupation with the costs and revenues of airports and too little concern with the benefit they bring to the community.

Navigation Needs

Since it became apparent that the airlines are not in dire financial shape, many governments have moved toward a policy of charging for the use of navigational facilities, according to Sir William. International Civil Aviation Organization is preparing a study on navigational facilities, having just completed one on airport charges.

The airlines realize there are certain facilities, such as communication facilities with commercial application, which they should pay for, according to Sir William. But the carriers also believe that the provision of facilities for safety and regularity of flight is an essential public service to be paid for out of public funds, he said.

Sir William also pointed out that a new class of bigger, faster airliners will be flying in a few years and considerable effort must be applied to promoting adequate navigational facilities to handle such operations.

The Director General outlined a number of factors he feels are essential for the healthy development of aviation and a satisfactory relationship between airline and government.

Sir William said the airlines would like to have the governments take a less mechanical and arbitrary approach to their needs. They would like to have their problems better understood and be treated as a responsible industry capable of maintaining its position and planning its development.

The airlines would also like to have equal treatment with other forms of transportation, to have the same kind of regulation and follow the same commercial principles as the railroads and steamship lines.

The airlines would like to be considered an asset to the community and a contributor to community development, and they would like to receive subsidies when they are necessary to support uneconomical public services, Sir William concluded.

International First Class Fares Increased 10% on Major Routes

A fare increase of 10% for some international first class services has been agreed upon by the International Air Transport Assn. There is no change, however, in the basic international air tourist fares.

The new rate schedules were worked out by the IATA Traffic Conferences in a three-week session at Miami Beach, Fla.

Subject to approval by about 40 nations, they will become effective Apr. 1, 1956.

Other changes made at the IATA meeting include:

- **Slight increases** in general air cargo rates in some areas.
- **An extension** of the recently simplified cargo rate system on the North Atlantic route through 1956.
- **Extending the family fare** plan on the North Atlantic, which starts Nov. 1, through the winter of 1956-57.
- **Abolishing** the open-jaw discount, a procedure that permits a passenger to use a different terminal for return on a round-trip flight.

Under the terms of the agreement there will be a 5% increase in first class fares between Europe and India and over Pacific routes and a 10% increase elsewhere with the exception of North and South America or on routes from Australia to South Africa, Tokyo and New Zealand.

The key international fare between New York and London will become $440 one-way and $792 for round-trip during the on-season and $742 round-trip off-season for first class. Sleeper surcharges for berth accommodation on all first class services will also be increased 10% to $55.

Only increase proposed in tourist fares is an additional $10 on the mid-Atlantic route between Central and South America and Europe. At the same time, the wide range of reduced fares for night services will be maintained inside Europe while in the Middle East the number and extent of "B" class fares will be increased.

A wider distinction between tourist services and first class with additional "luxury" governed the decision to raise international first class fares. Hugh B. Main, chairman of the IATA Conferences, said, "While we have succeeded in holding the price line for basic transport service on tourist aircraft, we have had to increase the charge for first class service in order to meet the demands of those passengers who want more luxury and who can afford to pay for it." He added, "If a service costs more to produce, we've got to charge more for it."

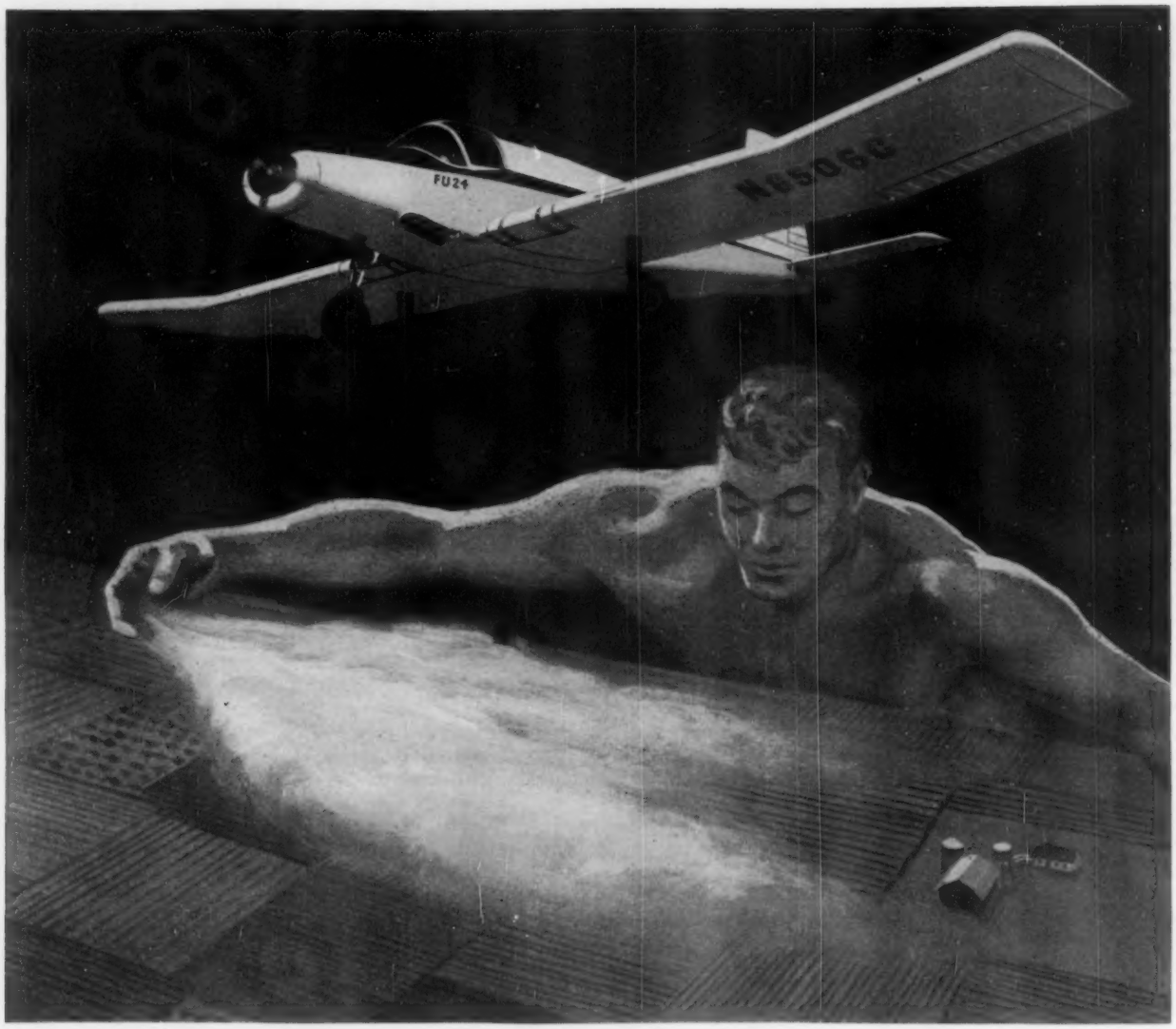
An example cited for improving first class service is the substitution of sleepcrettes for normal seating. However, such an arrangement reduces the number of passenger accommodations in many aircraft types by as much as one-fourth.

IATA found no acceptable standard

New Atlantic Fare

A 40% reduction in international tourist fares has been proposed by Pan American World Airways and Trans World Airlines for U. S. military personnel, effective Nov. 1. The new low rates apply on only travel from Europe to the U. S. and return, and only for members of the armed forces on furlough, traveling at their own expense.

An example of the proposed rates is a round-trip fare of $354.40 between Frankfurt, Germany, and New York compared to the normal on-season round-trip fare of $590.60.



AERIAL AID TO AGRICULTURE

Save time and money with the Fletcher FU-24 UTILITY.

The C.A.A. approved UTILITY is designed for agricultural use. One hundred FU-24's sold to New Zealand operators have proved their ability to do agricultural jobs better and faster.

Attractive insurance rates enable you to finance this aircraft through conventional banking channels.

Check these Specifications...
They Tell the Story!

Maximum Speed	More than 125 MPH
Cruising Speed	More than 105 MPH
Range — 44 gallons	407 miles
Rate of climb at sea level at Gross Weight	610 FPM
Take-off (Flaps 20° sod field)	
Sea level over 50-foot obstacle	870 Feet
Take-off Speed	50 MPH
Minimum Speed at Gross Weight	
Flaps Up	56 MPH
Flaps Down	48 MPH
Weight Empty	1890 lbs.
Useful Load	1610 lbs.
Gross Weight	3500 lbs.
Dimensions	
Wing Span	42'0"
Overall Length	31'10"
Height	9'4"

C.A.R. Part 3

FLETCHER
aviation corporation
Fletcher Airport, Rosemead, Calif.

ATTENTION ENGINEERS — Fletcher Aviation has openings offering unusual opportunity to qualified personnel.

formula for tourist seat accommodations that will fit all the variations of existing and prospective aircraft. As a result, the conference was forced to agree upon stipulating minimum seating charts for 29 different aircraft types.

Exceptions to the maintenance of present air cargo rates is an approximate 5% increase on the South Atlantic route, routes between Europe and the Middle and Far East (excluding Australia and New Zealand) and (southbound only) from Europe to Africa.

A number of IATA study groups were appointed at the conferences to report on these subjects:

- **Expanding air cargo.**
- **New promotional measures** to increase off-season passenger traffic over the North Atlantic.
- **Integration of helicopter services** into the existing commercial network.
- **Simplification of fares** and regulations.
- **Remedies for the problem** of "no-shows" and late cancellations.

One phase of the simplication program which was adopted by IATA at Miami Beach is a new reservations interline message procedure. The system is called AIRIMP and was jointly arranged by IATA and the U. S. Air Traffic Conference. AIRIMP offers a uniform system of abbreviations and sequence of elements in reservations messages that can reduce a 35 word message to a series of seven short abbreviations. AIRIMP gets by with only 99 abbreviations compared with the old system that required 340.

TWA Helicopter Plan

Trans World Airlines last week announced that it will offer helicopter transfer service between the three major New York airports beginning Nov. 1 for passengers arriving for and departing from trans-Atlantic flights.

The shuttle service, which is subject to Civil Aeronautics Board approval, was provided for in an arrangement between TWA and New York Airways and is similar to a previously announced plan by Pan American Airways (AW Oct. 10, p. 115). The airline will also continue to provide ground transfer services between the airports—New York International, La-Guardia and Newark—for its trans-Atlantic passengers.

New MATS Contract

Transocean Airlines has received a contract from the Military Air Transport Service for a number of roundtrip flights between the West Coast and Japan. The westbound flights will carry cargo and the return flights will be divided between passenger and cargo movements.

CAB Reduces Subsidy Estimates For Second Time in Eight Months

Washington—For the second time in less than a year, the Civil Aeronautics Board has surveyed the airline subsidy situation and made sharp reductions in subsidy estimates.

In reports issued in February and September, CAB estimated that the airlines will get less subsidy and less total mail pay in present and future periods. The reports also revealed several airline operations which no longer require subsidy.

In the latest report, subsidy needs for Fiscal 1956 and 1957 are set at $48.5 million. This amount is 33% less than subsidy for Fiscal 1954 and 13% under the Fiscal 1955 subsidy.

The new estimate is $4 million less than Congress appropriated for airlines subsidy this year. Most of the reductions in the estimates were made in the international operations.

Two trunk carriers—Braniff Airways and Continental Air Lines—are off subsidy for the first time this year, although Continental still receives support for the local service routes it took over when it acquired Pioneer Air Lines this year. Colonial Airlines and Northeast Airlines remain on subsidy.

In the international area, trans-Pacific operations of Pan American World Airways and Northwest Airlines are subsidy free for the first time. Trans World Airlines has operated without subsidy on trans-Atlantic routes since 1953, and Pan American draws $2.5 million on trans-Atlantic operations not comparable with TWA's.

In Latin American operations, Pan American, Braniff, Panagra and Caribbean-Atlantic still require subsidy, although the amount is substantially reduced.

CAB Subsidy Estimates

	Fiscal 1956	Fiscal 1957
	(000 omitted)	
Domestic trunks	$2,193	$2,187
Local service ..	24,088	24,008
Helicopters ...	2,814	2,803
States-Alaskan operations ..	3,343	3,325
Intra-Alaskan operations ..	3,723	3,674
Hawaiian operations	293	293
Trans-Atlantic operations ..	2,454	2,294
Latin American operations ..	9,811	9,862
Totals.....	$48,719	$48,446

Subsidy requirements for local service and helicopter operations remain stable at $24 million and $2.8 million respectively.

Operations between the United States and Alaska are reported to require about $3.4 million and intra-Alaska operations $3.7 million.

The figures quoted by CAB are estimates, since rates of some of the airlines covered in the report are not final.

CAB Chairman Ross Rizley attributed the reductions to seven factors:

- **High level** of economic activity.
- **Expansion** of air transportation services, particularly the sharp increase in low-cost aircoach services both domestically and on a world-wide basis.
- **Air transportation** is a good buy for the consumer's dollar.
- **Excellent safety** and dependability record of the airline industry.
- **Increased volume** of military mail moving by commercial air carrier.
- **Effect of these factors** on the improved economic condition of the airlines and reflection of such improvement in rate orders of the Board.
- **Increased efficiency** of the airlines.

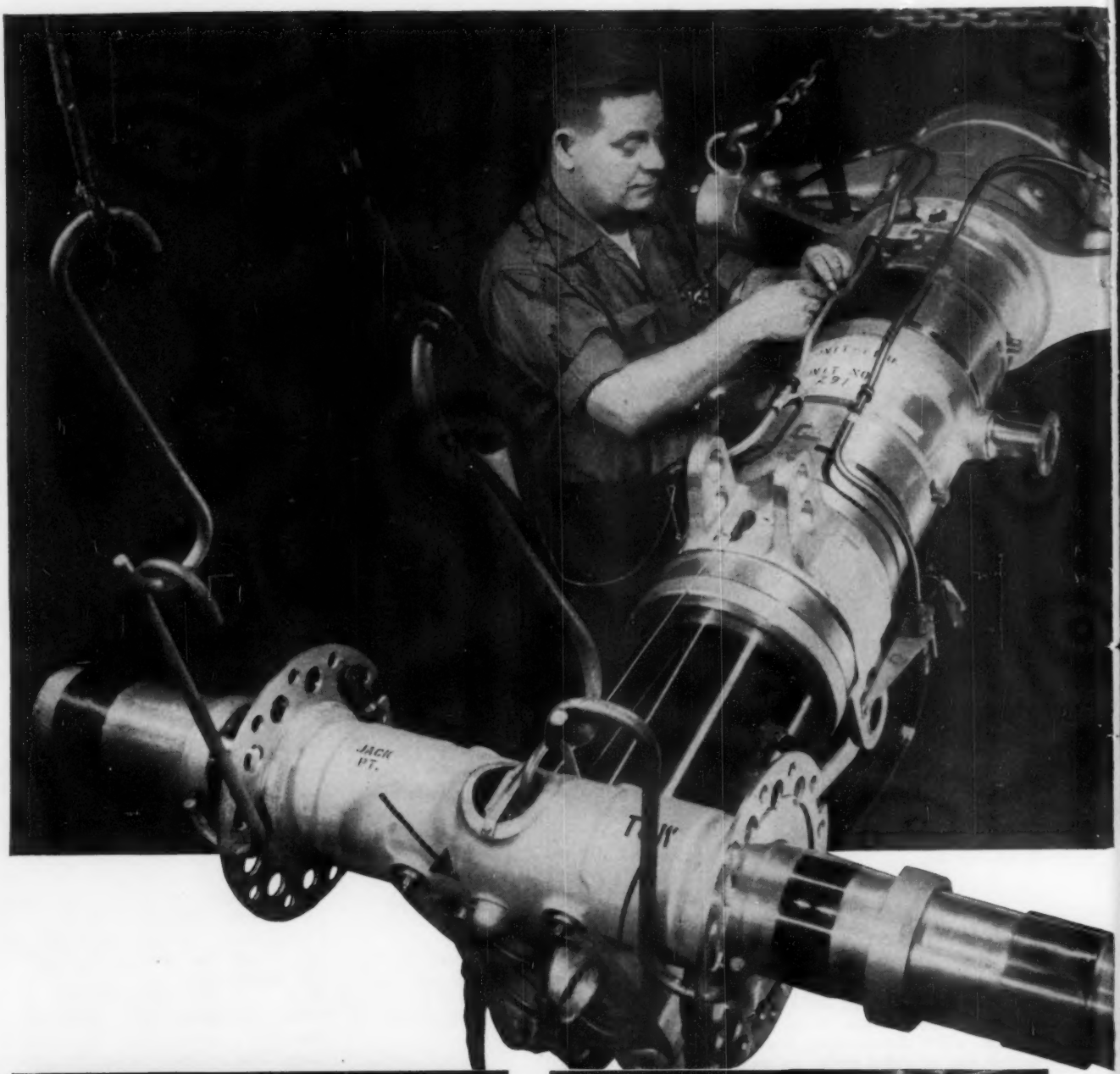
SHORTLINES

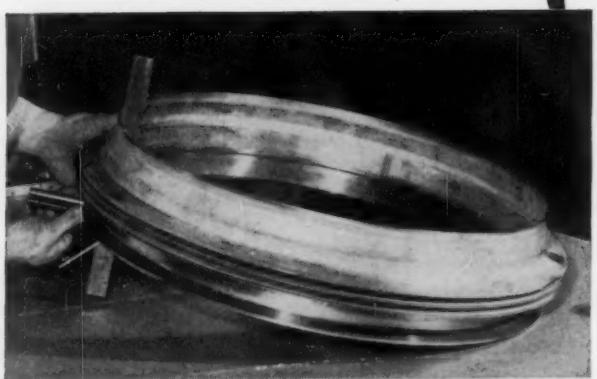
▶ **Braniff International Airways** is purchasing an electronic reservations system that will keep track of seats on all flights 31 days in advance and automatically notify the airlines sales agents of seat availabilities.

▶ **Mohawk Airlines** has purchased its fourth Convair 240 from Northeast Airlines. The addition brings the present Mohawk DC-3 and Convair fleet to 15 aircraft.

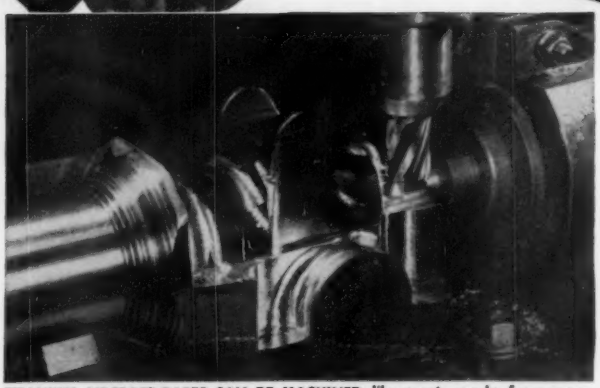
▶ **North Central Airlines** passenger boardings during September exceeded by 59% the boardings for the same month in 1954. The airline carried 45,535 revenue passengers in September 1955.

▶ **Severson Air Activities, Inc.,** Cut Bank, Mont., has been licensed by the Canadian Air Transport Board to operate a non-scheduled air charter service to Brandon, Winnipeg, Moose Jaw, Prince Albert, Regina, Saskatoon, Calgary, Edmonton, Lethbridge, Medicine Hat and Vancouver, Canada. The aircraft to be used over the routes are restricted to payloads of less than 6,000 lb.

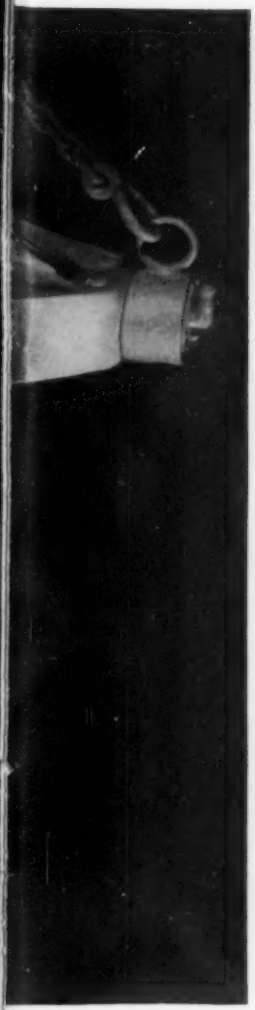




ENDURO STAINLESS STEEL DOES MANY AIRCRAFT JOBS EFFICIENTLY AND ECONOMICALLY. Here ENDURO is used in a bellows that goes between jet engine and exhaust tubes because of its heat-resistance and ability to expand and contract uniformly. There are other advantages—like increased structural strength without added weight, corrosion-resistance, high physical and chemical properties. Republic metallurgists will help you use ENDURO to best advantage.



TITANIUM AIRCRAFT PARTS CAN BE MACHINED like parts made from many other metals. This part is being hogged out of a titanium forging at Cleveland Pneumatic Tool Co. It will then be turned, drilled, reamed, ground, tapped, and threaded. Republic metallurgists recommend metals without prejudice. They will tell you whether titanium can be adapted to your product—will help you use it to advantage. Republic produces titanium and titanium alloys in hot and cold rolled bars, sheets, plates and billets.



Alloy Steels soften the shock of a 100-ton sock

And here's proof. Shock-absorbing landing gear struts and component parts, like the one illustrated, are made from alloy steels. The toughness of alloy steels helps these struts withstand the shock, impact, strain and vibration of up to 180 tons of aircraft hitting the runway at better than 100 miles per hour.

Alloy steels are exceptionally strong. Their high strength-to-weight ratio permits smaller sections to carry heavier loads with no sacrifice of strength or safety. They resist fatigue—maintain their great strength even at wide temperature extremes.

Alloy steels are uniform in response to heat treatment. They produce hard, wear-resistant surfaces around tough cores.

Republic, world's largest producer of alloy and stainless steels, offers you its 3-D Metallurgical Service to help you get the most from alloy steels at the lowest possible cost.

The coupon will bring you more information by return mail.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

WHATEVER THE WING SPAN, TRUSCON CAN MAKE THE HANGAR DOOR TO ACCOMMODATE IT. Republic's Truscon Division knows the answers to big-door problems—has 28 years' experience in steel hangar door design and manufacture. Illustrated are the simplest and least expensive of all types, the motor-driven, Straight Slide Doors. Other door designs include Tail, Braced and Unbraced Canopy, Vertical Lift Canopy. Truscon engineers and field crews will help you plan and get the best door installation.

REPUBLIC STEEL CORPORATION
3118 East 45th Street
Cleveland 27, Ohio

Please send more information on:

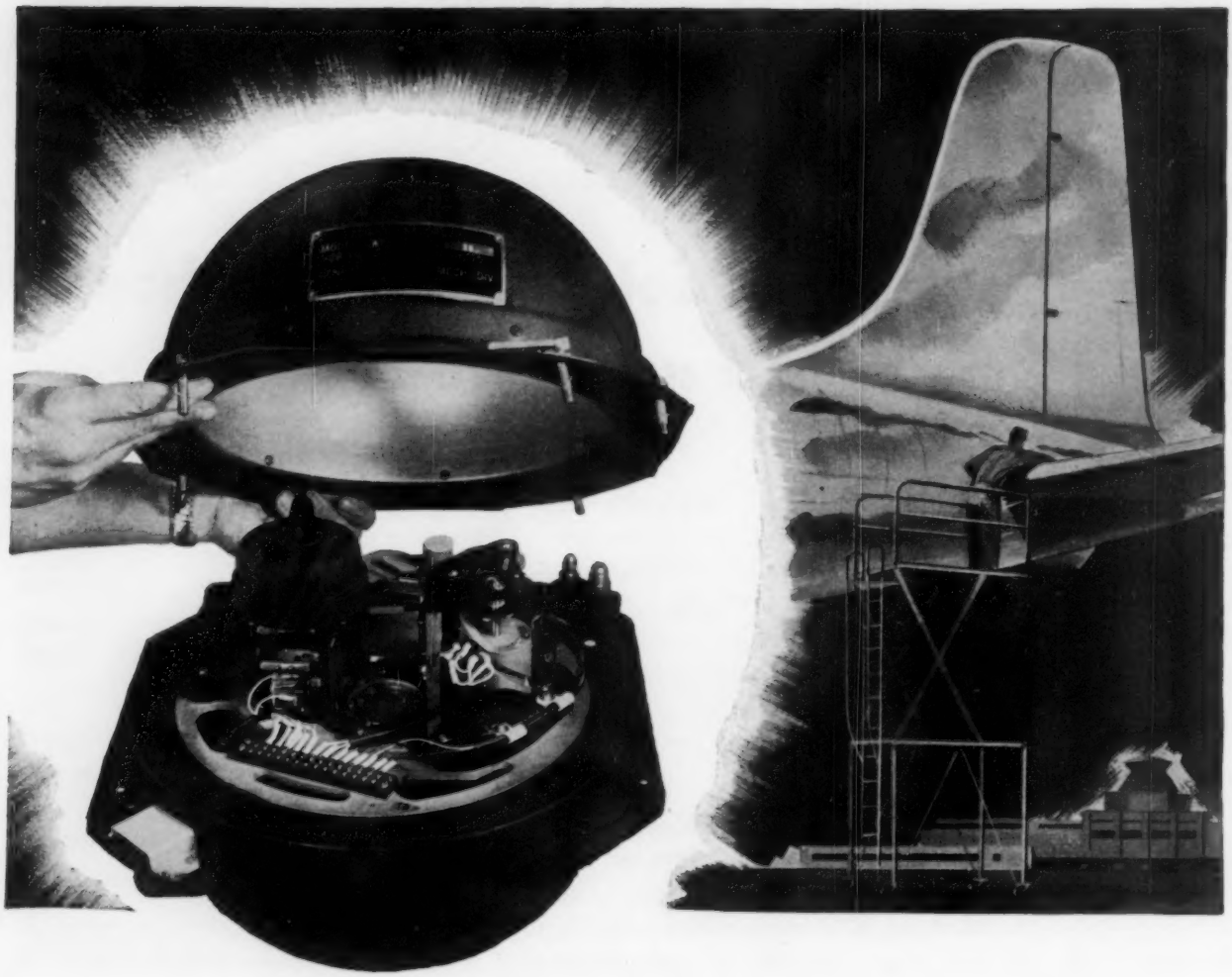
☐ Alloy Steels ☐ ENDURO® Stainless Steels
☐ Titanium ☐ Truscon Hangar Doors

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____



UNNECESSARY INSPECTIONS WASTE YOUR MONEY

General Mills Flight Recorder tells when plane checks are called for

Here's an inexpensive, lightweight device that lets you safely extend the period between structural inspections of your aircraft. Any variations from normal flight conditions—unusual turbulence aloft, excessively hard landings—are accurately recorded by the General Mills Flight Recorder. With it, your crew chiefs can determine instantly whether an inspection is necessary; all costly guesswork is eliminated. In addition, the Recorder supplies statistical information of value in checking your operational and safety standards.

The Recorder is a compact, sturdy instrument with no electronic circuitry. It is simple to maintain and offers assured repeatability. Let it save you money by keeping your planes in the air earning revenue . . . instead of undergoing needless inspections!

CHECK THESE FEATURES OF THE GENERAL MILLS FLIGHT RECORDER

☐ Records altitude, airspeed, vertical acceleration and direction of flight. ☐ The flight record is protected to withstand 2,000°F heat for a half hour, shocks up to 100 G. ☐ Weight is about half that of other commercial recorders measuring the same functions. ☐ Recorder continues to operate for a minimum of 10 minutes following power failure. ☐ No electronics—provides reliable results with a minimum of maintenance. ☐ Inscribes a continuous 300-hour recording on aluminum foil—a direct, permanent record that requires no photographic processing or magnetic playback. ☐ No special remote sensing pickups required.

FULL DETAILS on the General Mills Flight Recorder will be gladly sent on request. Write, wire or phone: Sales Dept., Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn. STerling 9-8811.

MECHANICAL DIVISION OF General Mills, Inc.

Flying Tigers to Abandon DC-6s Upon Lockheed 1049H Delivery

Los Angeles—Flying Tigers, Inc., will dispose of its entire Douglas DC-6 and DC-4 fleet when it takes delivery of ten Lockheed 1049H Super Constellation air freighters in 1957.

This was announced last week by president Robert Prescott when he outlined the modernization program under which the air freight firm plans to finance its $20-million order.

In a speech before the Aviation Writers Assn., Prescott said his firm will dispose of its present aircraft on this schedule:

- **The company will trade four DC-6As,** now leased to Northwest Airlines, to Lockheed Aircraft Corp. for $7-million, $5-million of which will be used to pay off a bank loan and the other $2-million set aside for financing of the Super Constellations. Northwest retains the aircraft, with Lockheed taking over lease.
- **Before June 30, 1956, the firm will sell** the three DC-6s it is now operating. These will be sold for delivery to the buyer about March, 1957, tying in with delivery dates on the Constellations.

"The market indicates we can expect about $3½-million, all of which will be applied to the new financing program," Prescott said.

- **The six Flying Tiger DC-4s** will be sold in the same way as the DC-6s and are expected to bring about $2½-million.
- **The company expects to derive $500,000** from sale of six or seven DC-4s.

"The net effect of these plane dispositions is to increase our book value from approximately $7-million to $10½-million," Prescott said. "In addition we have $2½-million in outstanding bonds which are subordinate to bank borrowings on new equipment."

This will give the Tigers an effective net worth of $13-million insofar as its borrowing power from the banks is concerned, the president said. "If conditions so warrant it, we will sell additional equity securities. We will be borrowing between $12 and $14-million from the banks for this."

Prescott pointed out that such a program not only will finance the Super Constellation purchases but also dispose of obsolete equipment. It will leave the air freight firm with only two types of aircraft to maintain, the Super Constellation and the C-46, which the company will continue to use as a feeder.

Prescott said one of the important factors in choosing the Super Constellation freighter was the delivery date. "We will get the planes starting early in 1957, a year before we could receive any other equipment," he said. "As you know, that is highly important to us. One of the very real problems of a new company such as ours in a field that already has established competition is the time-lag between ordering and getting equipment."

Another deciding factor was the aircraft itself.

"We like the airplane," Prescott said. "It will carry nearly one-third more than the DC-6A, and it will fly 10% cheaper. On our transcontinental schedules, we estimate it will cut two hours from our coast-to-coast operation. It will be cheaper because of its ability to fly larger loads faster, thus enabling us to give better service and, therefore, generating additional traffic from high freight potential centers."

He gave this comparison:

The DC-6A has a productivity of 4,800 ton-miles an hour times the load, 16 tons. This is nearly two-and-one-half times the productivity of the C-54. The Super Constellation will have a productivity of about 7,000 ton-miles an hour. Thus, one 1049H will do the work of more than three C-54s or one and one-half that of the DC-6As.

The need for this type of aircraft has been demonstrated in the acceptance of the new Flying Tiger direct New York-Los Angeles service. This schedule moves freight from New York to Los Angeles in 11 hours with no intermediate freight stops and only one refueling stop.

"It is too soon yet to accurately gauge the results," Prescott said. "But the first week's operation has been most encouraging, for we have been flying with nearly 100% load factors in both directions."

During August and September, he said, the airline operated at the highest level of common carriage air freight traffic in its history.

CAB ORDERS

(Sept. 29-Oct. 5)

GRANTED:

Flying Tiger Line an exemption to perform two flights from Baltimore, Md., to Hamburg, Germany, pursuant to a contract with the Caribbean Atlantic Steamship Co.

Northwest Airlines leave to intervene in the North Central Airlines Permanent Certification Case.

United Air Lines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

Leave to intervene in the Erie-Detroit service case to City of Bradford, Pa., Aviation Commission, and the Dearborn, Mich., Chamber of Commerce. Petitions of County of Chemung, N. Y., City of Elmira, N. Y., City of Jamestown, N. Y., Aviation Commission, Lancaster, Pa., Airport Authority, City of Ogdensburg, N. Y., City of Worcester, Mass., and the Zanesville, Ohio, Airport Commission are denied.

Pan American World Airways an exemption to conduct air transportation at Tafuna, American Samoa, from Suva, Fiji, in addition to its Honolulu-Australia services via Canton Island, for one year.

Delta Air Lines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

Flying Tiger Line an exemption to perform 36 flights from London, Paris, Brussels, Bremen, Hamburg, Munich, Linz, Milan, Rome and Athens to New York pursuant to a contract with the Intergovernmental Committee for European Migration.

Leave to intervene in the New York-Nassau case to the Bahamas Development Board, the Bahamas Chamber of Commerce and the Bahamas Hotel Assn., Ltd., Nassau, Bahamas Islands.

Trans World Airlines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

APPROVED:

Agreements between Trans World Airlines, Los Angeles Airways and various other carriers relating to inter-carrier arrangements.

Resolutions between various carriers adopted by the International Air Transport Assn. which enable Eastern Air Lines, Braniff Airways, National Airlines, Pan American World Airways and Pan American-Grace Airways to arrange for delayed inaugural flights over their newly instituted interchange services between the U. S. and Latin America.

ORDERED:

Investigation of the United Air Lines 10-day round trip excursion fare between various points which includes automobile rental.

DISMISSED:

Eastern Air Lines' motion to make final the portion of the examiner's decision in the Northeast-Southwest Service Case which would remove Eastern's "closed door" restriction at Pittsburgh on Route 6.

Ozark Air Lines' applications for a certificate, for suspension of Lake Central Airlines' certificate and for acquisition of Lake Central Airlines, at the request of the applicant.

Braniff Airways' applications for service to Saskatchewan, Canada, Santa Cruz, Bolivia and Denver, Colo., at the request of the applicant.

DENIED:

Eastern Air Lines' petition for reconsideration of CAB action awarding Ozark Air Lines a temporary route between Paducah and Louisville, Ky., via Owensboro.

National Airlines and Pan American World Airways' joint petition for reconsideration and approval of a proposed National-Pan American interchange plan.

Aero-Copters, Inc. petition for reconsideration of CAB action extending operations of Okanagan Helicopters Ltd., in the State of Washington.

Capital Airlines

VISCOUNT

POWERED BY ROLLS-ROYCE

Rolls-Royce built the first
propeller turbine aero engine to fly.

★

A Rolls-Royce propeller turbine
engine was the first to be officially approved
for civil aviation.

★

The only propeller turbine engined airliners
in service in the world are powered by Rolls-Royce Darts.

★

Rolls-Royce Dart engines have run
nearly 600,000 hours on airline service.

★

Dart engines are flying over 2,000 hours every day.

ROLLS-ROYCE LIMITED · DERBY · ENGLAND

Airline Traffic—August 1955

	Revenue Passengers	Revenue Passenger Miles (000)	Revenue Passenger Load Factor	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American Airlines	629,571	389,995	**67.95**	1,458,861	1,020,573	6,167,911	45,837,590	**60.07**
Braniff Airways	134,889	50,597	**58.79**	155,440	124,616	318,701	5,441,693	**53.40**
Capital Airlines	238,652	74,401	**58.53**	254,960	274,966	352,830	7,994,368	**44.42**
Colonial Airlines	40,983	10,096	**49.74**	13,512	7,828	33,748	994,906	**49.09**
Continental Air Lines	*	21,021	**53.29**	64,606	24,452	111,718	2,213,366	**45.28**
Delta Air Lines	170,074	76,302	**60.92**	251,155	241,244	572,829	8,380,219	**56.35**
Eastern Air Lines	517,254	254,590	**60.20**	801,824	493,329	1,164,901	28,199,170	**46.90**
National Airlines	86,237	57,390	**60.06**	214,371	45,517	308,271	6,387,663	**59.86**
Northeast Airlines	78,867	15,750	**66.25**	11,893	18,778	33,797	1,490,768	**62.22**
Northwest Airlines	125,435	89,727	**71.77**	399,897	249,832	567,894	10,010,847	**62.98**
Trans World Airlines	344,822	278,489	**68.67**	1,025,745	777,783	2,149,230	30,612,480	**62.71**
United Air Lines	542,704	382,908	**73.64**	1,980,693	1,153,216	4,078,692	43,978,494	**63.71**
Western Air Lines	105,564	52,000	**64.89**	195,350	80,617	212,412	5,454,625	**58.08**
INTERNATIONAL								
Braniff Airways	3,251	6,858	**45.85**	25,397	.....	62,832	861,136	**46.05**
Caribbean Atlantic Airlines	11,898	923	**59.24**	964	.....	2,621	86,825	**55.29**
Colonial Airlines	2,914	2,259	**62.32**	92	.....	3,623	245,298	**66.15**
Delta Air Lines	5,032	5,759	**57.57**	7,287	.....	47,965	647,767	**45.45**
Eastern Air Lines	17,899	24,258	**73.61**	53,002	.....	81,973	2,698,589	**63.47**
National Airlines	9,953	4,717	**53.05**	7,477	3,081	49,632	541,063	**49.25**
Northwest Airlines	10,227	20,381	**63.84**	821,024	19,187	546,754	3,538,229	**68.31**
Pan American World Airways								
Alaska	9,567	11,326	**70.28**	35,719	.....	417,961	1,575,355	**60.17**
Atlantic	92,487	121,717	**66.23**	802,906	.....	1,457,631	14,904,760	**64.56**
Latin America	100,671	94,313	**70.08**	296,173	.....	2,493,392	11,736,609	**64.21**
Pacific	22,910	69,020	**76.70**	1,031,866	.....	923,579	9,125,405	**73.20**
Pan American-Grace Airways	11,858	14,044	**58.66**	39,575	.....	185,611	1,713,138	**53.40**
Trans World Airlines	27,449	71,299	**70.21**	709,689	.....	661,662	8,802,177	**71.98**
LOCAL SERVICE								
Allegheny Airlines	37,658	6,025	**46.22**	7,291	18,901	.....	600,637	**46.68**
Bonanza Air Lines	10,520	2,203	**46.51**	3,194	1,921	4,681	221,223	**41.73**
Central Airlines	8,069	1,180	**25.83**	3,773	1,643	4,927	123,873	**23.58**
Frontier Airlines	18,091	4,720	**52.15**	15,212	8,622	58,887	533,473	**61.90**
Lake Central Airlines	12,330	1,799	**34.60**	3,311	12,699	.....	178,719	**32.62**
Ozark Air Lines	23,162	3,438	**34.92**	7,617	16,103	.....	345,016	**35.54**
Piedmont Aviation	33,147	6,430	**53.85**	12,051	12,408	15,634	654,925	**53.50**
Southern Airways	15,184	2,498	**39.91**	8,529	12,529	.....	259,810	**38.31**
Southwest Airways	27,814	5,457	**62.41**	6,103	5,658	9,716	541,212	**60.74**
Trans-Texas Airways	13,455	3,020	**37.85**	12,936	5,837	14,612	321,019	**35.20**
West Coast Airlines	21,584	3,807	**51.61**	4,280	2,150	7,006	357,026	**51.53**
HAWAIIAN CARRIERS								
Hawaiian Airlines	50,906	7,139	**70.96**	3,316	.....	157,204	797,889	**60.13**
Trans-Pacific Airlines	23,707	3,073	**64.01**	858	36	12,261	239,082	**58.23**
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	531,079	531,079	**47.44**
Flying Tiger Line	2,532	3,772	**88.11**	.....	.....	4,240,753	4,617,945	**77.15**
Slick Airways	1,560	6,411	**76.52**	31,669	.....	5,314,716	5,987,437	**78.20**
Riddle Airlines	.....	.....	.....	266	.....	952,588	952,854	**88.06**
HELICOPTER SERVICE								
N. Y. Airways	2,680	53	**55.20**	1,036	1,268	417	7,455	**56.67**
Los Angeles Airways	637	20	.....	4,757	1,653	.....	8,377	**41.63**
Helicopter Air Service (Chicago)	.....	.....	.....	2,682	.....	.....	2,682	**42.00**

*Not available.

Compiled by AVIATION WEEK from airline reports to Civil Aeronautics Board.

Safety With Sense

Comes the fall of the year and advice to pilots blossoms forth on posters, handbills and memos by the ton. Via cartoons, catchy sayings, morals, codes and poems we are saturated by all manners of reminders aimed at safer flying. All good stuff understand. But the language! Eminently more suited for solo students (or the high school English class) than for the pro who faced the same glop last year.

The pilots of American Airlines were recently subjected to a bit of thinking of a different sort. It was written in creditable language so it got read. This reader found the material worthy of further circulation. Here is AA's Directory of Flight, Captain W. W. Braznell's memo to his pilots:

"A landing minimum is not a yardstick by which a captain's ability may be measured or one captain's ability measured against another when such minimums exist. The best captain is one who operates at all times within his personal limitations, his crew's limitations and his ship's limitations. A captain's limitations may change and frequently do from day to day. The same can be said for the limitations of his crew and the limitations of his ship.

Captain's Limitations

"Some of the factors varying a captain's (or other crewman's) limitations are: (a) physical or psychological factors such as mind troubled or untroubled—body rested or fatigued, everybody feeling good or there has been too much flying and waiting around, too much golfing, swimming or working on the farm, not enough sleep, too much of most anything. (b) Degree of familiarity with ship's operation (all hands). Degree of familiarity with airport and procedures.

"Some of the factors varying the ship's limitations are: (a) Everything working right?, or the vitally necessary clear windshield in the marginal category, or a horizon (or other control instrument) has not been behaving as it should, or a power plant giving trouble, or some part of the navigation or communications gear in the questionable category. (b) The weather situation—turbulence, ice. (c) The runway situation, icy, slippery with rain, nasty crosswind or questionable tailwind component.

Another Man's Poison

"So the old saying 'What is one man's meat is another man's poison' really applies to shooting minimums. Because the trip ahead of you 'gets in' does not necessarily mean you must 'get in' or even make the attempt. The other guy's situation may be considerably different from your own. Then, of course, there is the matter of rapidly varying ceiling and visibility conditions. (Rumor has it that weather reports sometimes do not keep up with the actual weather conditions prevailing.)

"A captain will never be criticized for not gaining access to an airport, even though the trip ahead and the trip behind lands. 200-½ means an approach must be more precise in execution than for 300-¾ or the higher minimums. Use these low minimums when the factors are in your favor for sound approach execution. Discontinue the approach should the degree of precision fall short of your expectations or whenever the weather conditions as viewed through your windshield do not meet (a) authorized minimums or (b) your requirements, which ever is the higher."

This information is good for several reasons:

First, because it was written by a fine pilot; Second, because he did not make the mistake of assuming his audience was composed solely of happy little sunbeams dancing around the sky and, Third, it has the courage to be practical. This combination makes the memo speak words that are genuine value to every pilot.

Engineers!

Join this winning team!

At DOUGLAS you'll be associated with top engineers who have designed the key airplanes and missiles on the American scene today. For example:

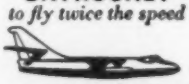
DC-7 "SEVEN SEAS" *America's finest, fastest airliner*

F4D "SKYRAY" *Only carrier plane to hold world's speed record*

C-124 "GLOBEMASTER" *World's largest production transport*

NIKE *Supersonic missile selected to protect our cities*

"SKYROCKET" *First airplane to fly twice the speed of sound*



A3D "SKYWARRIOR" *Largest carrier-based bomber*

A4D "SKYHAWK" *Smallest, lightest atom bomb carrier*

B-66 *Speedy, versatile jet bomber*

With its airplanes bracketing the field from the largest personnel and cargo transports to the smallest combat types, and a broad variety of missiles, Douglas offers the engineer and scientist unequalled job security, and the greatest opportunity for advancement.

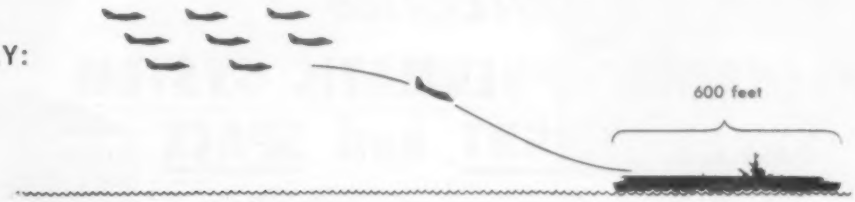
For further information relative to employment opportunities at the Santa Monica, El Segundo and Long Beach, California, divisions and the Tulsa, Oklahoma, division, write today to:

DOUGLAS AIRCRAFT COMPANY, Inc.

C. C. LaVene, Employment Mgr.
Engineering General Office
3000 Ocean Park Blvd.
Santa Monica, California

TACTICAL PROBLEM: *To design and build a jet bomber able to operate from the smallest World War II "jeep" carriers.*

PRACTICAL REPLY:

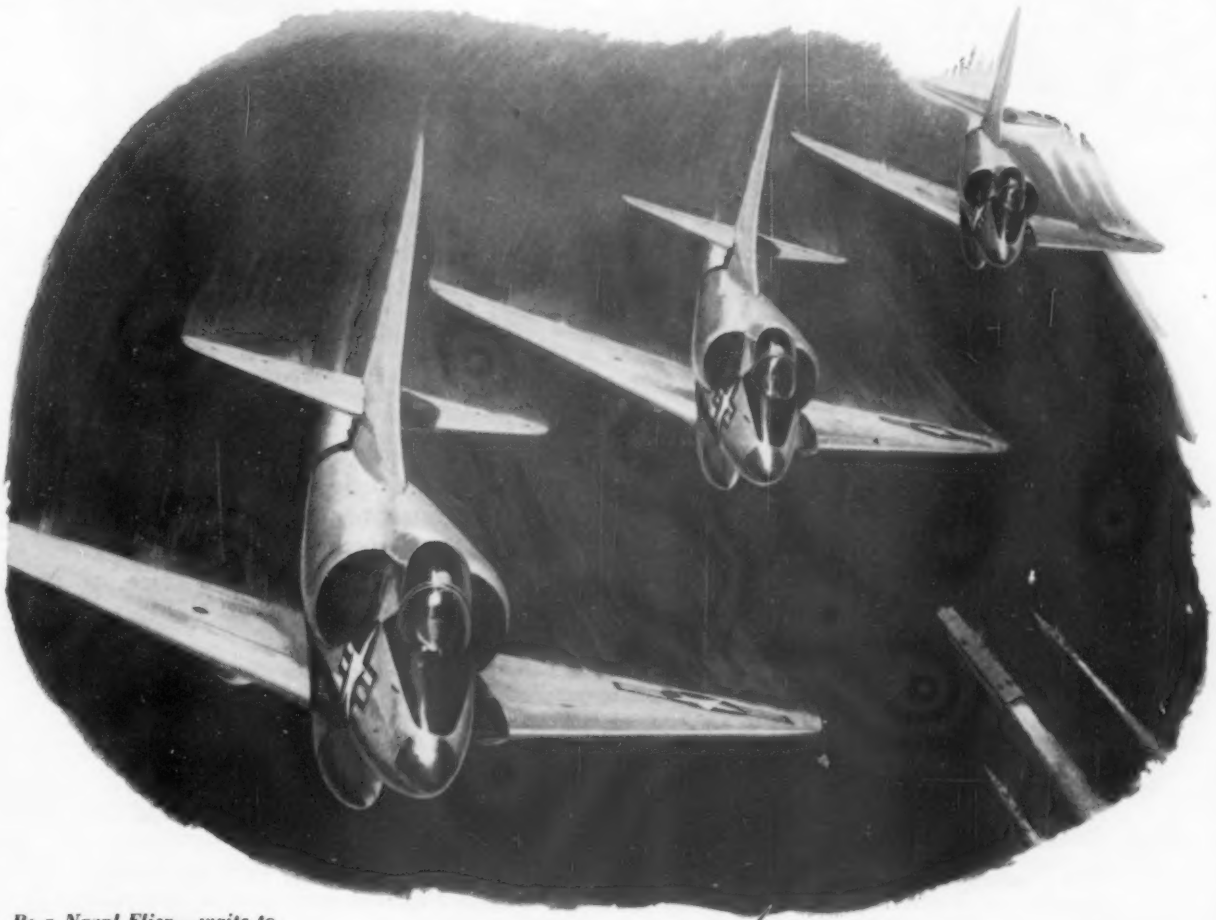


The DOUGLAS A4D Skyhawk

Designed for the U. S. Navy and now in volume production, the Douglas A4D Skyhawk cuts many of the tactical restrictions imposed by the higher landing and take-off speeds of modern jet aircraft.

This compact attack bomber flies faster and farther with a greater striking load than any airplane of comparable size . . . outspeeds many jet fighters twice its size. Yet it can fly with ease from "jeep" carriers and short, advanced airstrips barred to most jets. Wingspan is so short that Skyhawk can be stored in quantity aboard carriers *without folding its wings*—a simplification that makes important savings in both weight and fuel.

Performance of A4D Skyhawk is another example of Douglas leadership in aviation. Greater utility with lower production cost, through highly simplified design, is always a rule at Douglas.



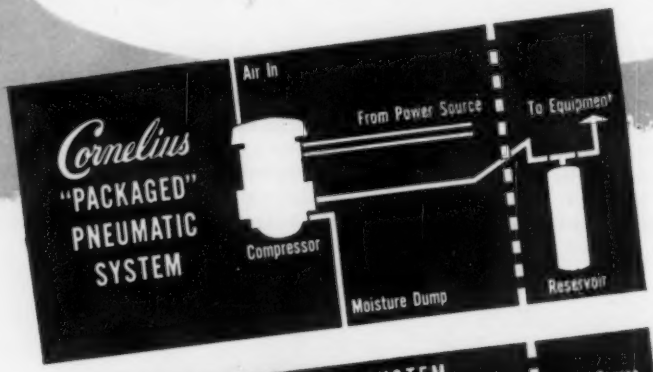
Be a Naval Flier—write to Nav Cad, Washington 25, D. C.

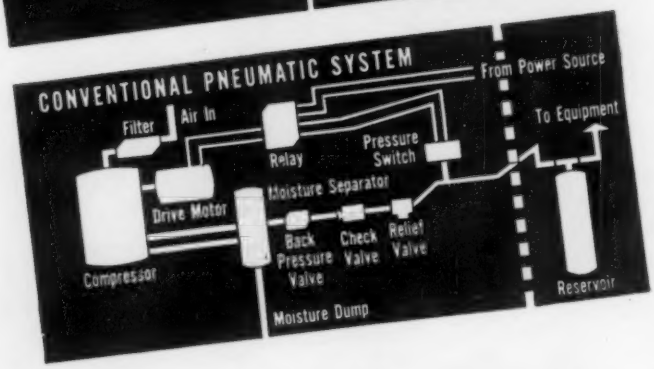
Depend on *DOUGLAS* **First in Aviation**

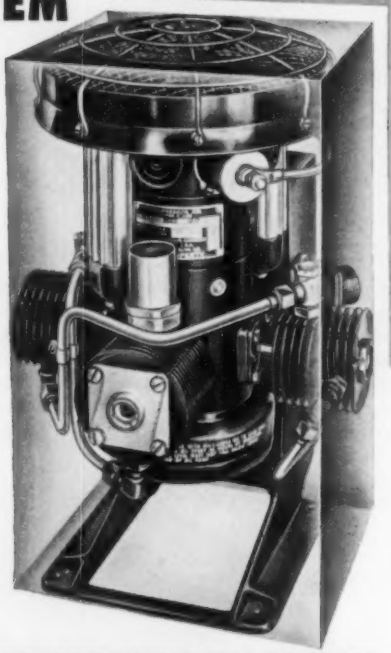
Cornelius

"PACKAGED" PNEUMATIC SYSTEM SAVES WEIGHT and SPACE

In fighters, bombers, aerial tankers, transports, trainers and helicopters







COMPLETE PNEUMATIC PACKAGE

*The Cornelius Compressor, Model 130, 2CFM, 3000 PSI, is used in the McDonnell F2H-3 and F3H, North American FJ-2 and FJ-3, Chance Vought F7U-3, and Grumman F11F-1. Also on order for the Lockheed P2V, Grumman S2F, Martin P5M, Boeing KC135, Boeing B52, Convair Turboprop Airliner and Canadair Britannia. Thousands of service hours under all operational conditions are proof of outstanding performance.

The Cornelius Model 130 compressor* is the heart of the complete Cornelius "packaged" pneumatic system which includes inlet air filter, starting relay, radio noise filter, moisture separator with automatic condensate dump and heating element, back pressure valve, check valve, relief valve and pressure switch.

Compact Design Saves Space—Entire air supply system occupies only slightly more space than compressor alone in conventional system.

Weight Savings of 5 pounds or more are possible by eliminating separate system components, associated tubing, fittings and flare connections.

System Leakage Is Reduced to a minimum because integration of components removes possible leakage sources such as flare connections and o-ring sealed fittings.

System Reliability Is Assured because each integral component is designed specifically to give optimum performance in combination with the other components.

Time Saved by installation and servicing of *one* unit is another valuable benefit which only Cornelius "packaged" pneumatic systems offer.

The Cornelius "packaged" pneumatic systems are available with either DC, AC or hydraulic motor drives. Please write us in order that a Sales Engineer may discuss with you the application of this "packaged" system as well as the many other pneumatic components which we manufacture.

THE CORNELIUS COMPANY 550 - 39th Ave. N. E., Minneapolis 21, Minnesota

PIONEERS IN THE DEVELOPMENT OF AIRCRAFT PNEUMATIC SYSTEMS

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—OCTOBER 17, 1955

ADEL PRECISION PRODUCTS A DIVISION OF GENERAL METALS CORP. 114
Agency—The McCarty Company

ADVANCE ELECTRIC & RELAY COMPANY 117
Agency—Waldie & Briggs, Inc.

AERO DESIGN & ENGINEERING COMPANY 78
Agency—Tom P. Gordon Co., Adv.

AERO SUPPLY MANUFACTURING CO. 85

AERO THERM CORPORATION THE 45
Agency—Hening & Company, Inc.

AIRBORNE ACCESSORIES CORP. 36
Agency—Gray & Rogers Adv.

ALAR PRODUCTS, INC. 28
Agency—C. D. Heiser Adv.

ALLISON DIV., GENERAL MOTORS CORP. ..... Fourth Cover
Agency—Kudner Agency, Inc.

AMERICAN CHAIN & CABLE, AUTOMOTIVE & AIRCRAFT DIV. 43
Agency—Reincke, Meyer & Finn, Inc.

AMERICAN ELECTRICAL SOCIETY 31

AMERICAN SEATING COMPANY 111
Agency—Roche, William & Cleary, Inc.

APPLIED SCIENCE CORP. OF PRINCETON 4
Agency—Paul M. Healy Adv. Service

ARO EQUIPMENT CORP. THE 39
Agency—Beeson-Reichert, Inc.

ATLAS PRECISION PRODUCTS CO. DIV. OF PRUDENTIAL INDUSTRIES 90
Agency—A. E. Aldridge Associates

AVION INSTRUMENT CORPORATION 21
Agency—Charles W. Curts Adv. Agency

AERNCO ENGINEERING CORP. 131
Agency—Bull Advertising Agency

BLISS COMPANY, E. W. 80
Agency—Feeley Advertising Agency

CAMLOC FASTENER CORPORATION 23
Agency—Lewis Advertising Agency

CHAIN BELT COMPANY, SHAFER BEARING DIV 82
Agency—The Buchen Company

CHAMPION SPARK PLUG CO. 76, 77
Agency—MacManus, John & Adams, Inc.

CHANDLER-EVANS DIV., NILES-BEMENT-POND CO. 68, 69
Agency—Hugh H. Graham & Associates, Inc.

CITIES SERVICE OIL CO. 42
Agency—Ellington & Co., Inc.

CLARY CORPORATION (AIRCRAFT DIV.) 103
Agency—Erwin, Wasey & Company, Ltd.

CLIFFORD MFG. CO., DIV. OF STANDARD-THOMSON CORP. 6
Agency—Shattuck, Clifford & McMillan, Inc.

COLE ELECTRIC COMPANY 51
Agency—Taggart & Young, Inc.

CONTINENTAL MOTORS CORP. (AIRCRAFT ENGINE DIV.) 83
Agency—The Hopkins Agency

CONVAIR A DIVISION OF GENERAL DYNAMICS CORP. 95
Agency—Thomas L. Yates Adv.

CORNELIUS COMPANY, THE 148
Agency—Scrymiger & Osterholt Adv.

CURTISS WRIGHT CORP. 54
Agency—Burke Dowling Adams, Inc.

DAGE ELECTRIC CO., INC. 67
Agency—Jim Bradford Adv.

DARNELL CORP., LTD. 72
Agency—Henry L. Rhea Adv.

deHAVILLAND ENGINE CO. LTD., THE 115
Agency—Samson Clark & Co., Ltd.

DOUGLAS AIRCRAFT CO., INC. 146, 147
Agency—J. Walter Thompson Co.

DOW CORNING CORPORATION 119
Agency—Church & Guisewite Adv.

EATON MANUFACTURING CO. (AIRCRAFT DIV.) 32
Agency—Clark & Bobertz, Inc.

EASTMAN KODAK CO., (X-RAY DIV.) 86
Agency—J. Walter Thompson Co.

EDISON, INC., THOMAS A. (INSTRUMENT DIV.) 41
Agency—Gaynor, Coleman, Prentis & Varley, Inc.

EDGEWATER STEEL COMPANY 97
Agency—Walker & Downing Industrial Adv.

ESSO EXPORT CORPORATION 47
Agency—McCann-Erickson, Inc.

FAIRCHILD ENGINE & AIRPLANE CORP. 132
Agency—Gaynor, Coleman, Prentis & Varley, Inc.

FARNSWORTH ELECTRONICS COMPANY 92
Agency—Chamberlin-Junk Adv., Inc.

FINN & CO., INC., T. R. (ELECTRONICS DIV.) .. 46
Agency—Feeley Adv. Agency

FLETCHER AVIATION CORPORATION 138
Agency—Hixson & Jorgensen, Inc.

GARRETT CORP. (AIRESEARCH MFG. DIV.) .. 54, 55
Agency—J. Walter Thompson Co.

GENERAL ELECTRIC COMPANY 48, 49, 50, 73, 74, 75
Agency—G. M. Basford Company

GENERAL MILLS, INC. (MECHANICAL DIV.) 142
Agency—Batten, Barton, Durstine & Osborn, Inc.

GIANNINI & CO., INC., G. M. 33
Agency—Western Adv. Agency, Inc.

GOODRICH CO., THE B. F. (TIRE & EQUIPMENT DIV.) 3
Agency—Batten, Barton, Durstine & Osborn, Inc.

GOODYEAR AIRCRAFT CORP. 105
Agency—Kudner Agency, Inc.

HARVEY ALUMINUM DIV. OF HARVEY MACHINE CO., INC. ..... Third Cover
Agency—Hixson & Jorgensen, Inc.

HI-SHEAR RIVET TOOL COMPANY, THE 8

HYDRO-AIRE, INC. 25
Agency—Roy S. Durstine, Inc.

IDEAL AEROSMITH, INC. 44
Agency—Mack-Wharton Adv.

INTERNATIONAL RESISTANCE CO. 70
Agency—Arndt-Preston-Chapin-Lamb & Keen, Inc.

INTERNATIONAL TELEPHONE & TELEGRAPH CORP. 26, 27
Agency—J. M. Mathes, Inc.

JACK & HEINTZ, INC. 59
Agency—Fuller & Smith & Ross, Inc.

JOHNS-MANVILLE PRODUCTS 22
Agency—J. Walter Thompson Co.

KAISER ALUMINUM & CHEMICAL SALES, INC. .. 96
Agency—Young & Rubicam, Inc.

KAYNAR COMPANY, THE KAYLOCK DIV. ..... Second Cover
Agency—J. H. Strauss & Co.

LAVELLE AIRCRAFT CORP. 87
Agency—The Roland G. E. Ullman Organization

LELAND ELECTRIC COMPANY, THE 116
Agency—Fletcher D. Richards, Inc.

LOCKHEED AIRCRAFT CORP. 52, 53
Agency—Foote, Cone & Belding

MARQUARDT AIRCRAFT COMPANY 131
Agency—Heintz & Co., Inc.

McGRAW-HILL BOOK CO., INC. 91

McGRAW-HILL PUBLISHING CO., INC. 88, 89

MENASCO MANUFACTURING CO. 134
Agency—The McCarty Company

MINNEAPOLIS HONEYWELL REGULATOR CO. ..... Front Cover
Agency—Foote, Cone & Belding

MINNESOTA MINING & MFG. CO. (ADHESIVES & COATINGS DIV.) 40
Agency—MacManus, John & Adams, Inc.

NORTHROP AIRCRAFT, INC. 149
Agency—West-Marquis, Inc.

OLIN MATHIESON CHEMICAL CORP. 58
Agency—Doyle, Kitchen & McCormick, Inc.

OLIN MATHIESON CHEMICAL CORP. (EXPLOSIVES DIV.) 65
Agency—D'Arcy Advertising Co.

PACIFIC AIRMOTIVE CORP. 30
Agency—West-Marquis, Inc.

PACIFIC DIV., BENDIX AVIATION CORP. 52
Agency—The Shaw Company Adv.

PASTUSHIN AVIATION CORP. 10
Agency—Lynn-Western, Inc.

PESCO PRODUCTS DIV., BORG-WARNER CORP. .. 110
Agency—The Jayme Organization, Inc.

PIONEER CENTRAL DIV. BENDIX AVIATION CORP. 101
Agency—MacManus, John & Adams, Inc.

REPUBLIC STEEL CORP. 140, 141
Agency—Meldrum & Fewsmith, Inc.

RHEEM MFG. COMPANY, GOVT. PRODUCTS DIV 19
Agency—Campbell-Ewald Co.

ROBINSON CO., RALPH C. 107
Agency—Chapin-Damm Adv.

ROHR AIRCRAFT CORPORATION 64
Agency—Barnes Chase Company

ROLLS-ROYCE LTD. 144
Agency—The Wesley Associates

SARGENT ENGINEERING CORP. 84
Agency—Darwin H. Clark Co. Adv.

SAWYER & SON CO., THE H. W. (COATED FABRICS DIV.) 66
Agency—Shattuck, Clifford & McMillan, Inc.

SEARCHLIGHT SECTION 121, 122, 123, 124, 125, 126, 127, 128, 29, 30

SHAFER BEARING DIV., CHAIN BELT COMPANY 82
Agency—The Buchen Company

SHORT BROS. & HARLAND LTD. 108
Agency—S. T. Barland Adv.

SIKORSKY AIRCRAFT DIV., UNITED AIRCRAFT CORP. 56, 57
Agency—Lennen & Newell, Inc.

SKYLINE PRODUCTS, INC. (AVIATION DIV.) ... 149
Agency—Triton Advertising

SOLAR AIRCRAFT COMPANY 106
Agency—The Phillips-Ramsey Co. Adv.

TECO, INC. 8
Agency—Jayecraft Co.

TWIN COACH CO., AIRCRAFT DIVISION 102
Agency—Palm & Patterson, Inc.

TWOMEY CO., INC., E. F. 107
Agency—Willard G. Gregory & Co.

UNITED STATES RADIUM CORPORATION 107
Agency—Lethen Advertising

VACUUM METALS CORPORATION 24
Agency—G. M. Basford Company

VARD, INC. 20
Agency—Graphics, Inc.

VICKERS-ARMSTRONGS AIRCRAFT LTD. 136
Agency—McCann-Erickson, Inc.

WAKMANN WATCH COMPANY 65
Agency—Ashe & Engelmore Adv., Inc.

WARREN WIRE COMPANY 133
Agency—Jules L. Klein Adv.

WEMAC COMPANY 29
Agency—McKee-Burns Adv.

WESTINGHOUSE ELECTRIC CORP. 98, 99, 100
Agency—Fuller & Smith & Ross, Inc.

WICKES ENGINEERING & CONSTRUCTION CO. ... 120

WYANDOTTE CHEMICALS CORP. 38
Agency—Brooke, Smith, French & Dorrance, Inc.

A precision ball joint connector designed & developed by Skyline

SKYLINE

PRECISION SHEET METAL & MACHINE PARTS
COMPLETE ENGINEERING SERVICE
A.F. CERTIFIED SPOT WELDING & OTHER WELDING PHASES
ELECTRONIC PARTS AND EQUIPMENT
AIRCRAFT FABRIC COVERING
GALLEYS AND COMMISSARY EQUIPMENT
GROUND SERVICING EQUIPMENT

SKYLINE PRODUCTS INC.

GRAND BOULEVARD, DEER PARK, NEW YORK

AERODYNAMICISTS

★ New subsonic and supersonic projects are creating an urgent demand for aerodynamicists at Northrop Aircraft, Inc., America's first company in the vital development, design and production of all-weather and pilotless aircraft.

★ If your training and experience qualify you for one of these challenging assignments, please telephone or wire collect:

Mr. Robert Ehinger
Manager of Engineering
Industrial Relations
Northrop Aircraft, Inc
Hawthorne, California

★ Expense-free Los Angeles interviews will be arranged for qualified applicants.

NORTHROP AIRCRAFT
INCORPORATED
HAWTHORNE, CALIFORNIA

EDITORIAL

Every Five Seconds

"Every five seconds day or night an aircraft is taking off for a regularly scheduled flight somewhere in the world." This theme of a booklet published jointly by the International Air Transport Assn. and the International Civil Aviation Organization provides a dramatic measure of the progress achieved in air transport during the past decade.

The scheduled airlines of the world are now carrying 23 times as many passengers as they did before World War II plus 70 times as much cargo and a thirteen-fold increase in mail. About 85% of current world airline traffic is carried by the 74 airlines flying under 40 different flags that have voluntarily banded together in the International Air Transport Assn. Today IATA begins its Tenth Anniversary General Meeting at the Waldorf-Astoria Hotel in New York under the presidency of Juan T. Trippe, a pioneer of international aviation and president of Pan American World Airways.

Delayed Honor

IATA embraces all kinds of airlines from globe-girdling giants such as Pan American, BOAC and Air France to tiny operators such as Cyprus Airways and Flugfelag Islands H. F. of Iceland. It also has no political distinctions. The Communist Czechoslovak Airlines (CSA) is a member although Russia's Aeroflot has not joined.

Juan Trippe's presidency and New York's playing host to IATA are long-delayed honors. Mr. Trippe was elected president of IATA's prewar predecessor, the International Air Traffic Conference, in 1939, and New York was scheduled as the annual meeting site for the fall of that year. Outbreak of war in Europe cancelled those plans which have waited until now for fruition. Actually this is the second time post-war IATA general meetings have been held in the United States. San Francisco was the site in 1950 when Warren Lee Pierson, board chairman of Trans-World Airlines, was president of IATA.

IATA can look back on a decade of solid achievement since its first post-war meeting in Havana. Perhaps the most significant is the fact that these national flag carriers have voluntarily spun their routes into an international network that enables an air traveller or shipper to arrange a trip or cargo shipment to any of the 3,500 cities on the air transport map with a single ticket. IATA activities involve an endless erosion of national barriers that prevent free flow of travel and commerce around the globe. The so-called "spirit of Geneva" prevailed in its councils long before it became a popular international political doctrine.

Although international air traffic is increasing steadily, the future outlook for operating airlines is not universally rosy. As Sir William Hildred, director general of IATA, emphasized in his annual report, the squeeze of rising operating costs against total airline revenues poses the gravest problem for healthy economic growth of the air transport industry.

Airline Problems

The air traffic control problem, already acute in the United States, also is an international problem. Unless the individual governments face up to their responsibility in providing adequate navigation and traffic control facilities, there will be serious limitations on traffic volume and severe economic penalties on use of new, technically improved gas-turbine airliners already in prospect for international routes.

Governments, Sir William indicates, are a major contributor to rising airline operating costs through imposition of new taxes such as users charges for airways facilities, higher airport landing fees and transportation taxes. Here IATA and its member airlines face a bitter battle if they are to prevent tax increases from further hacking away at the present narrow 3% margin of total world airline operating profit.

Future Growth

Future growth of international air traffic lies clearly in two directions:

• **Continued expansion of the tourist fare.** Nearly 70% of the 1954 record total of 550,000 North Atlantic air travellers flew on low-cost tourist service and their volume exceeded by 50,000 passengers the total North Atlantic traffic of only four years earlier. The growth of low-fare service and the promotion of tourist travel represent the greatest single area for international air traffic growth in the immediate future.

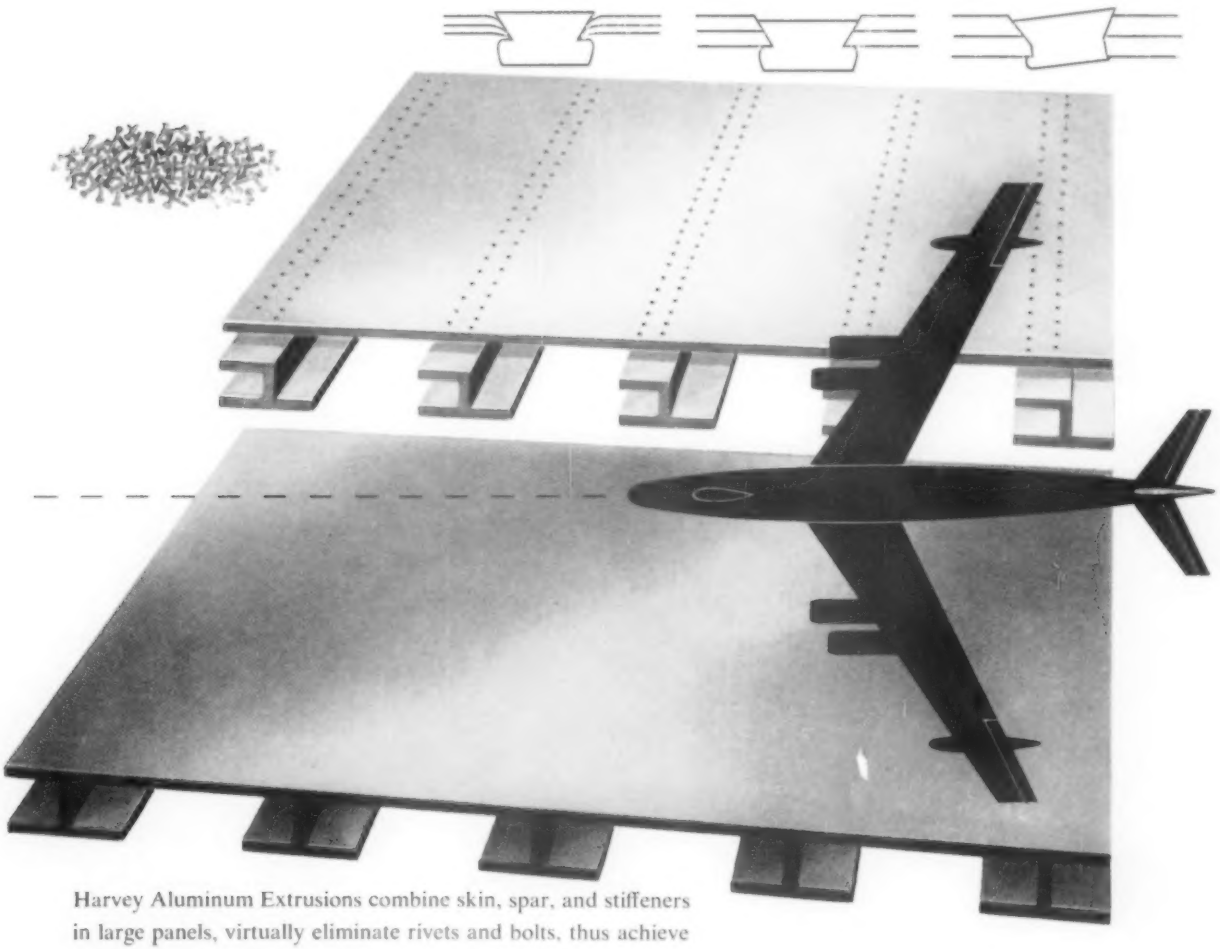
• **Establishment of efficient international air cargo service.** Air cargo offers its greatest dividends to shippers on long hauls and cargo aircraft that offer economical operations are now beginning to fly. This field offers a slower rate of growth in the immediate future but a long term potential far in excess of possible passenger traffic expansion. In expanding air cargo operations, the national walls of red tape present more formidable obstacles than sales and operations problems.

In its long fight to make swift international travel economically attractive to the people of the world and to erase unnecessary national barriers to the free flow of people and goods, IATA and its member airlines are making an enormous practical contribution to the cause of international understanding and peace.

—Robert Hotz

Harvey extrusions... simpler, smoother parts for better flight

Improperly installed rivets and bolts have always contributed heavily to the turbulence and drag that downgrade a plane's over-all performance. On light-gage skins, dimples result . . . on medium skins, rivets can be countersunk, but often end up below the desired surface . . . the steel bolts used on heavy skins just can't be shaved to surface smoothness.



Harvey Aluminum Extrusions combine skin, spar, and stiffeners in large panels, virtually eliminate rivets and bolts, thus achieve a degree of aerodynamic smoothness that reduces operating costs and improves performance. And at the same time, assembly is faster, sealing is eliminated, and inspection is simplified.

MAKING THE MOST OF ALUMINUM . . . FOR EVERYONE

Harvey is a leading independent producer of aluminum extrusions in all alloys and all sizes, special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tube, impact extrusions, aluminum screw machine products and related products. Also similar products in alloy steel and titanium on application.

HARVEY Aluminum

HARVEY ALUMINUM SALES, INC., TORRANCE, CALIFORNIA — BRANCH OFFICES IN PRINCIPAL CITIES

AMERICAN AIRLINES

America's Leading Airline

chooses Allison Turbo-Prop Power for 400-mile-an-hour luxury travel

New Lockheed Electras to give America the world's fastest, smoothest flights

AMERICAN AIRLINES has ordered Allison Turbo-Prop engines to power its new fleet of Lockheed Electra four-engine airliners to give America the world's finest air travel.

The Allison Turbo-Prop engine was chosen because it is the most advanced propeller-type aircraft engine available here or abroad – and the first Turbo-Prop to receive Civil Aeronautics Administration approval for commercial service.

The Lockheed Electra has been specially designed to take advantage of this new concept in aircraft power, and represents another major advancement in air transport.

These great new 64-passenger airliners will fly at speeds of more than 400 miles per hour–saving up to an hour on popular flights. They will operate from any airport now served – with much shorter take-offs and landings. And they will bring remarkable new standards of smoothness and comfort to air travel. These new luxury airliners are scheduled for delivery in 1958.

General Motors salutes American Airlines on this important step in continuing the advance of American aviation–and we are proud of our contribution to the progress of American-designed and American-built aircraft.

ALLISON DIVISION OF GENERAL MOTORS • Indianapolis, Indiana

The Allison Turbo-Prop engine is backed by more than six million hours of turbine engine flight time– experience where it counts most –in the air!

ALLISON TURBO-PROP ENGINES

AMERICAN BUILT FOR THE NEW ERA IN AIR TRAVEL